

NASA Contractor Report 191059

LOX/Hydrocarbon Rocket Engine Analytical Design Methodology Development and Validation

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LOX/HYDROCARBON ROCKET ENGINE
ANALYTICAL DESIGN METHODOLOGY
DEVELOPMENT AND VALIDATION

(Contract NAS 3-25556)

Final Report

VOLUME II
APPENDICES

Prepared
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APPENDIX A

MEASURED MANIFOLD AND CHAMBER MEAN
PRESSURES VERSUS TIME PLOT FOR
ALL SUCCESSFUL TESTS

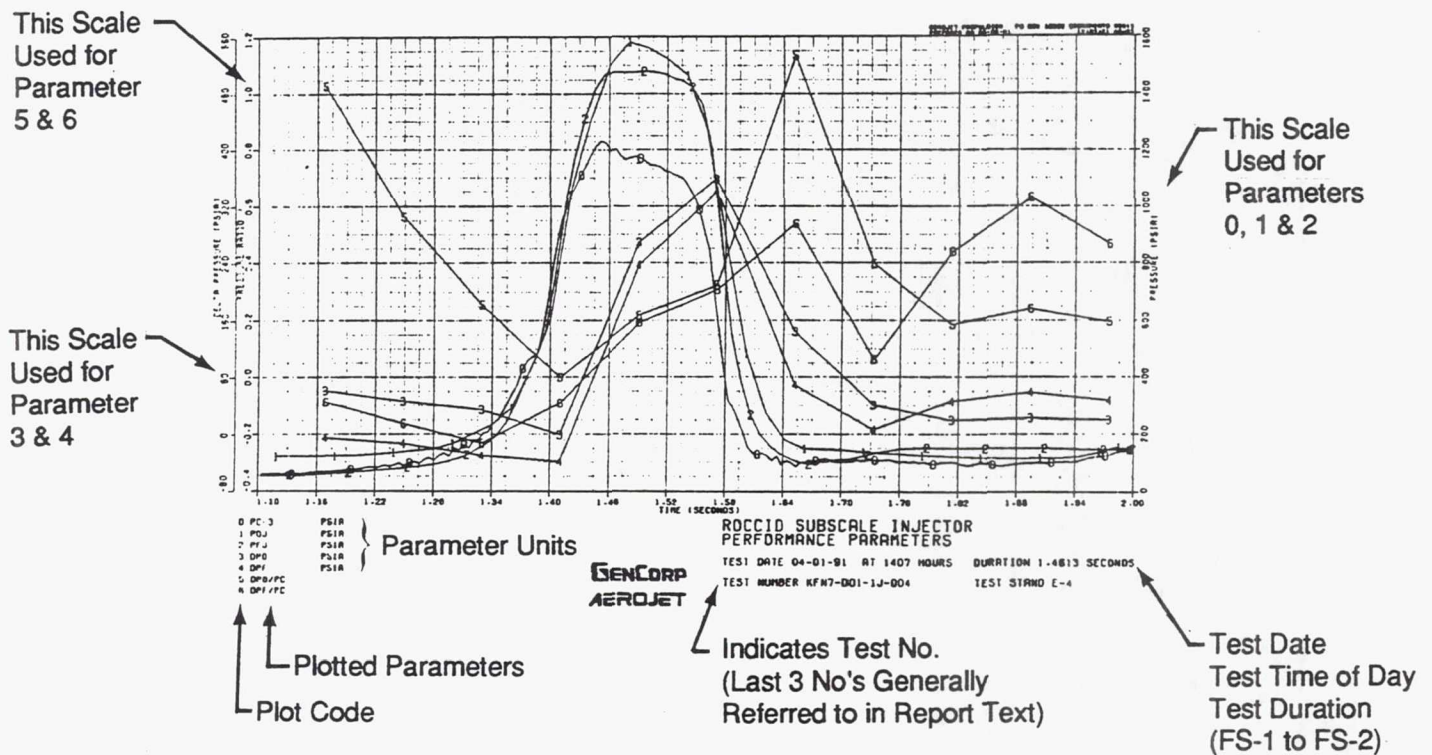
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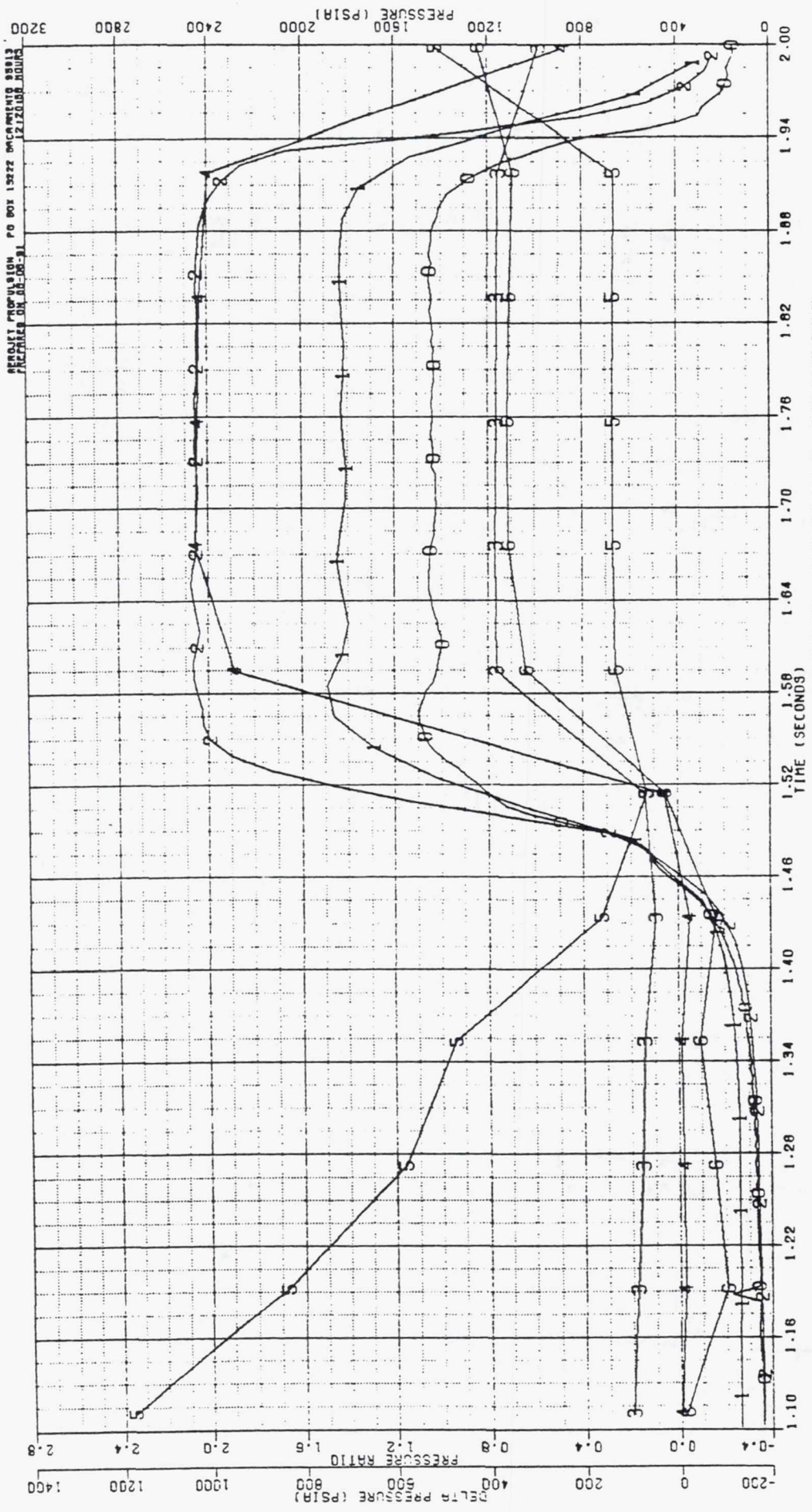
FOREWORD

This Appendix contains plots of selected pressure measurements as a function of time from the initial fireswitch (FS-1) activation. These plots were prepared from digital data obtained from the analog-to-digital converter for all 27 tests, where meaningful operation was achieved, in order to assess the combustion stability or instability characteristics of the combustor. The plots start at FS-1 + 1.10 seconds, which is the approximate time that the LOX/TEA + TEB ignition occurs. This hypergolic propellant combination is used as a combustion source to ignite the LOX/RP-1 propellants. Test data is plotted until well after the test shutdown switch (FS-2) in order to show pressure decays during the shutdown transient. Information contained in these plots are identified below:



PLOTTED PARAMETERS

PC-3	Chamber Pressure
POJ	LOX Injector Manifold Pressure
PFJ	RP-1 Injector Manifold Pressure
DPO	LOX Injector ΔP (POJ-Pc-3)
DPF	RP-1 Injector ΔP (PFJ-Pc-3)
DPO/Pc	DPO/Pc-3
DPF/Pc	DPF/Pc-3

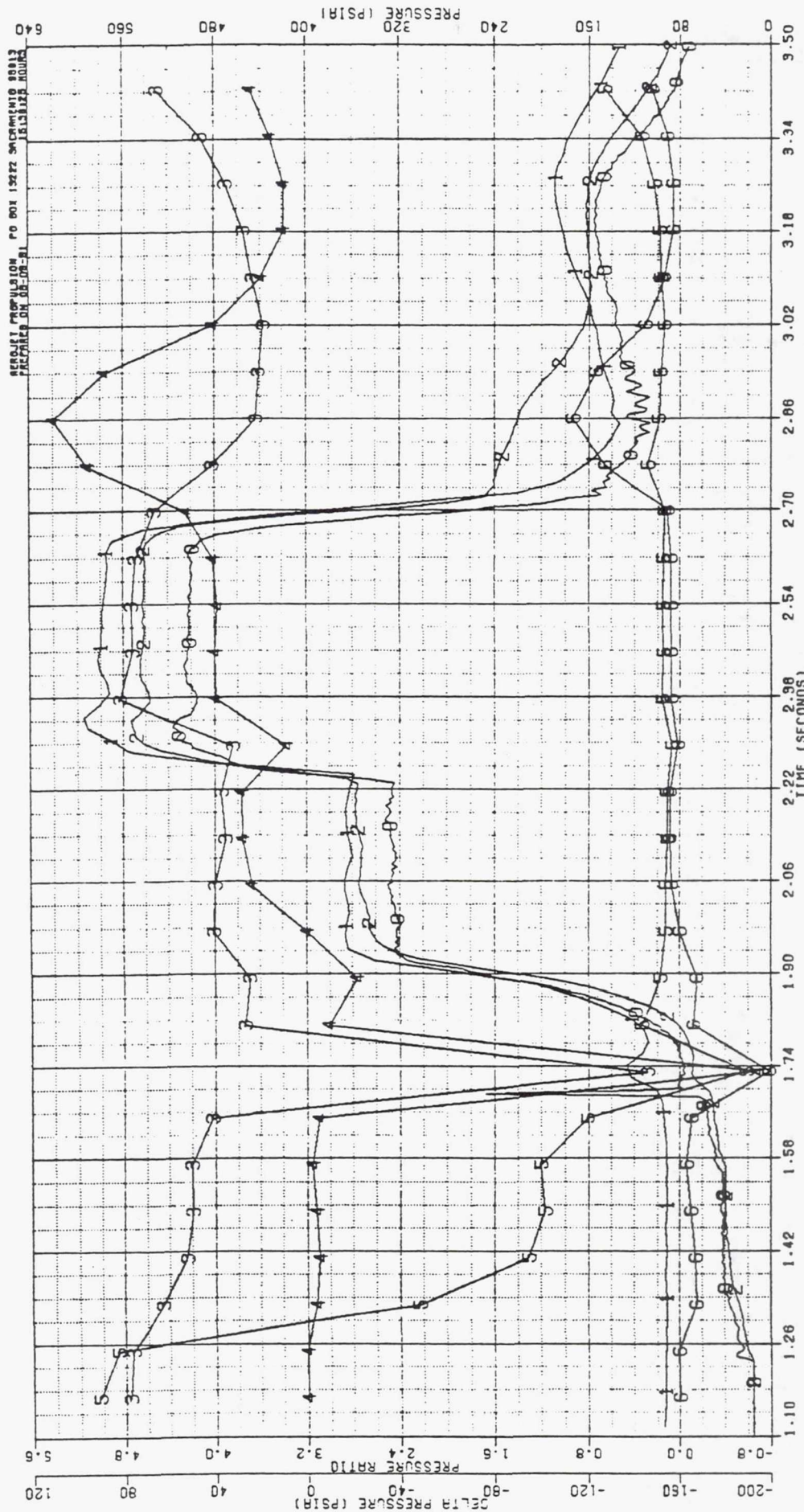


ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-04-91 AT 1115 HOURS DURATION 1.853 SECONDS
TEST NUMBER KFN7-001-1J-007 TEST STAND E-4

GENCORP
AEROJET

- 0 PC-3 PSIA
- 1 PC-3 PSIA
- 2 PC-3 PSIA
- 3 PC-3 PSIA
- 4 PC-3 PSIA
- 5 PC-3 PSIA
- 6 PC-3 PSIA

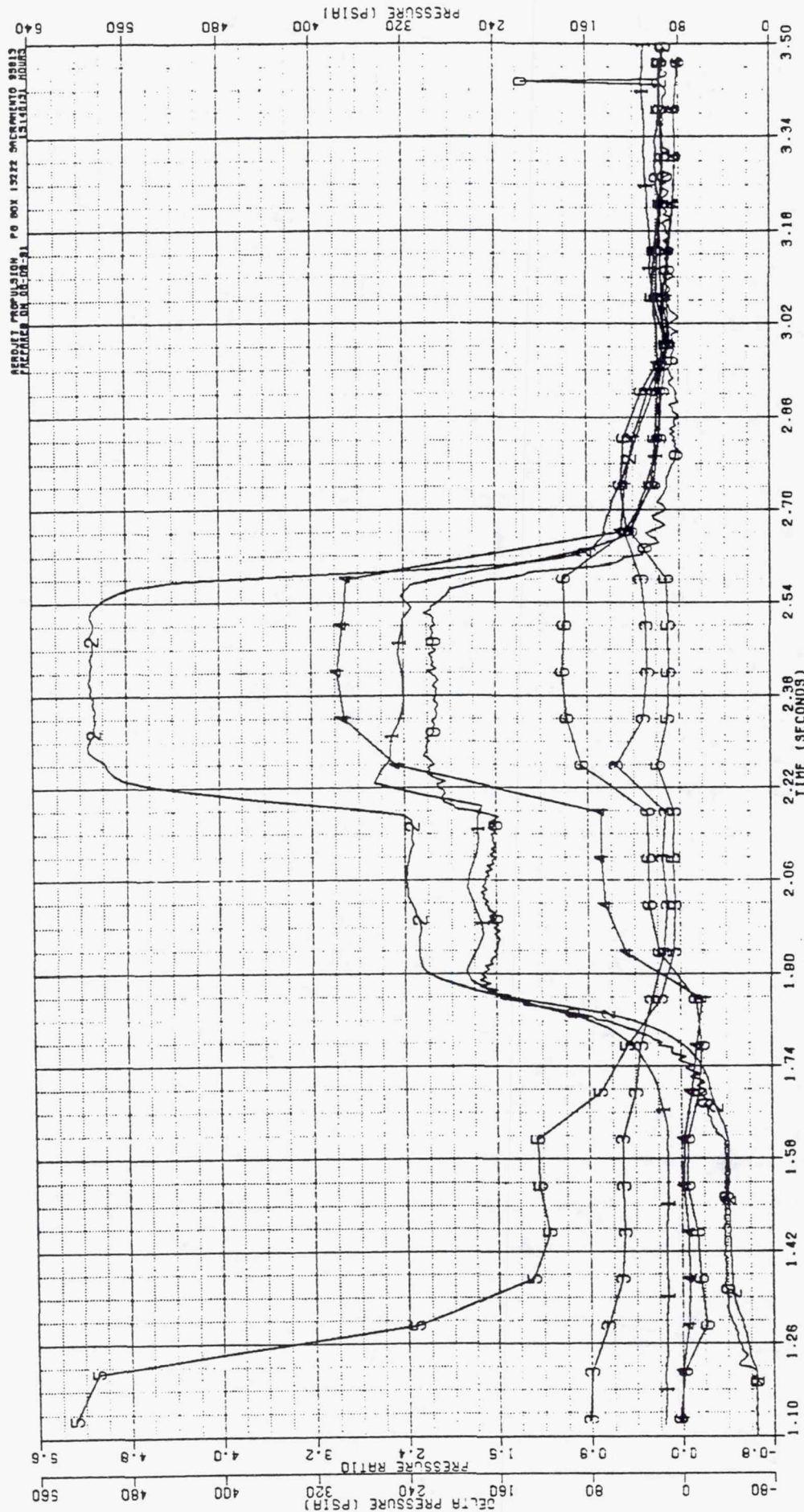


ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-04-91 AT 1522 HOURS DURATION 2.569 SECONDS
TEST NUMBER KFN7-001-1J-009 TEST STAND E-4

GENCORP
AEROJET

- 0 PC-3
- 1 PDJ
- 2 PFJ
- 3 DFO
- 4 DFF
- 5 DFO/PC
- 6 DFF/PC
- PSIA
- PSIA
- PSIA
- PSIA
- PSIA

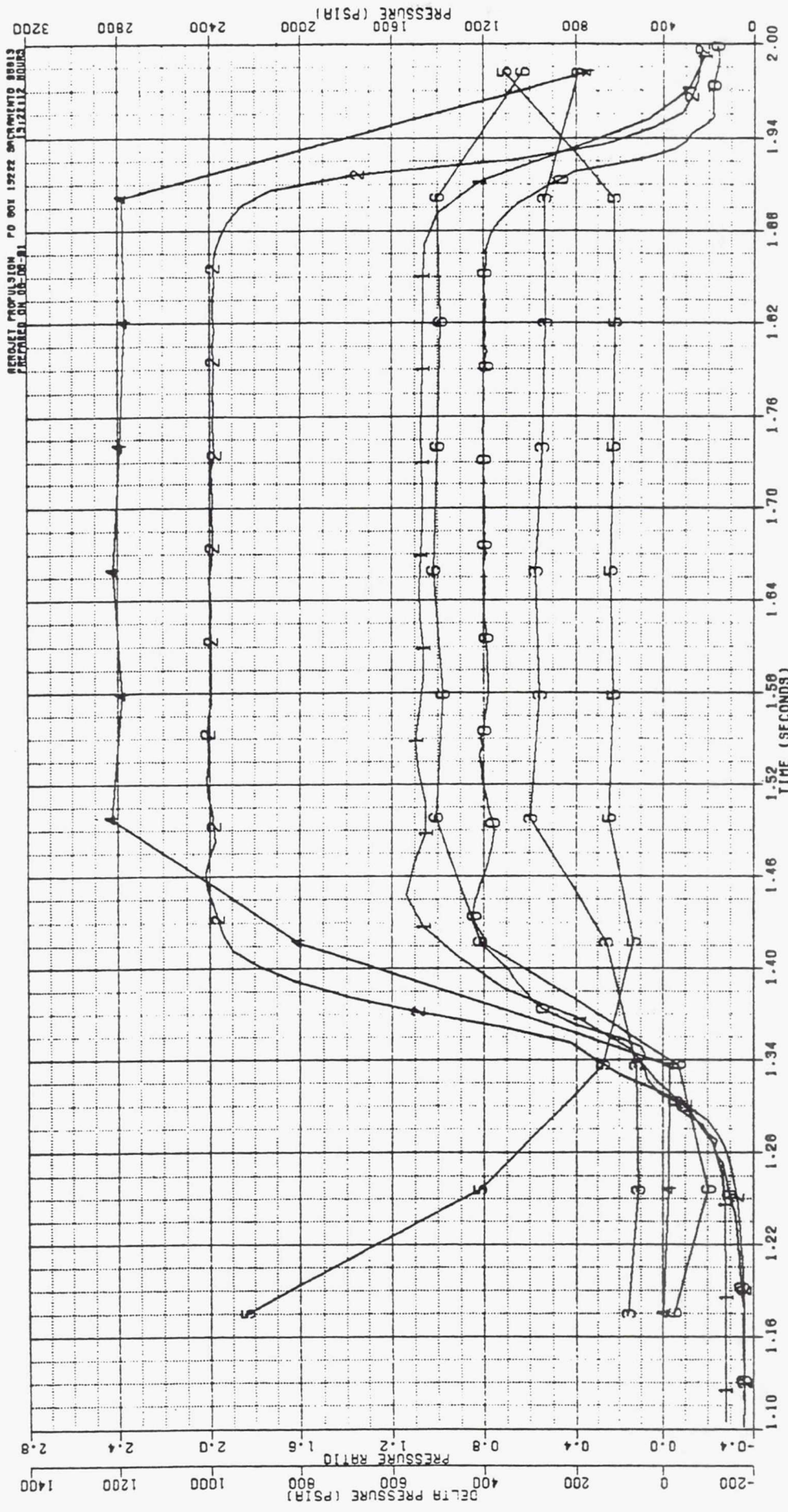


ROCCID SUBSCALE INJECTOR
PERFORMANCE PARAMETERS

TEST DATE 04-08-91 AT 1409 HOURS DURATION 2.494 SECONDS
TEST NUMBER KFN7-DOI-1J-012 TEST STAND E-4

GENCORP
AEROJET

- 0 PC-3 PSIA
- 1 POJ PSIA
- 2 PFJ PSIA
- 3 DPO PSIA
- 4 DPF PSIA
- 5 DPO/PC
- 6 DPF/PC

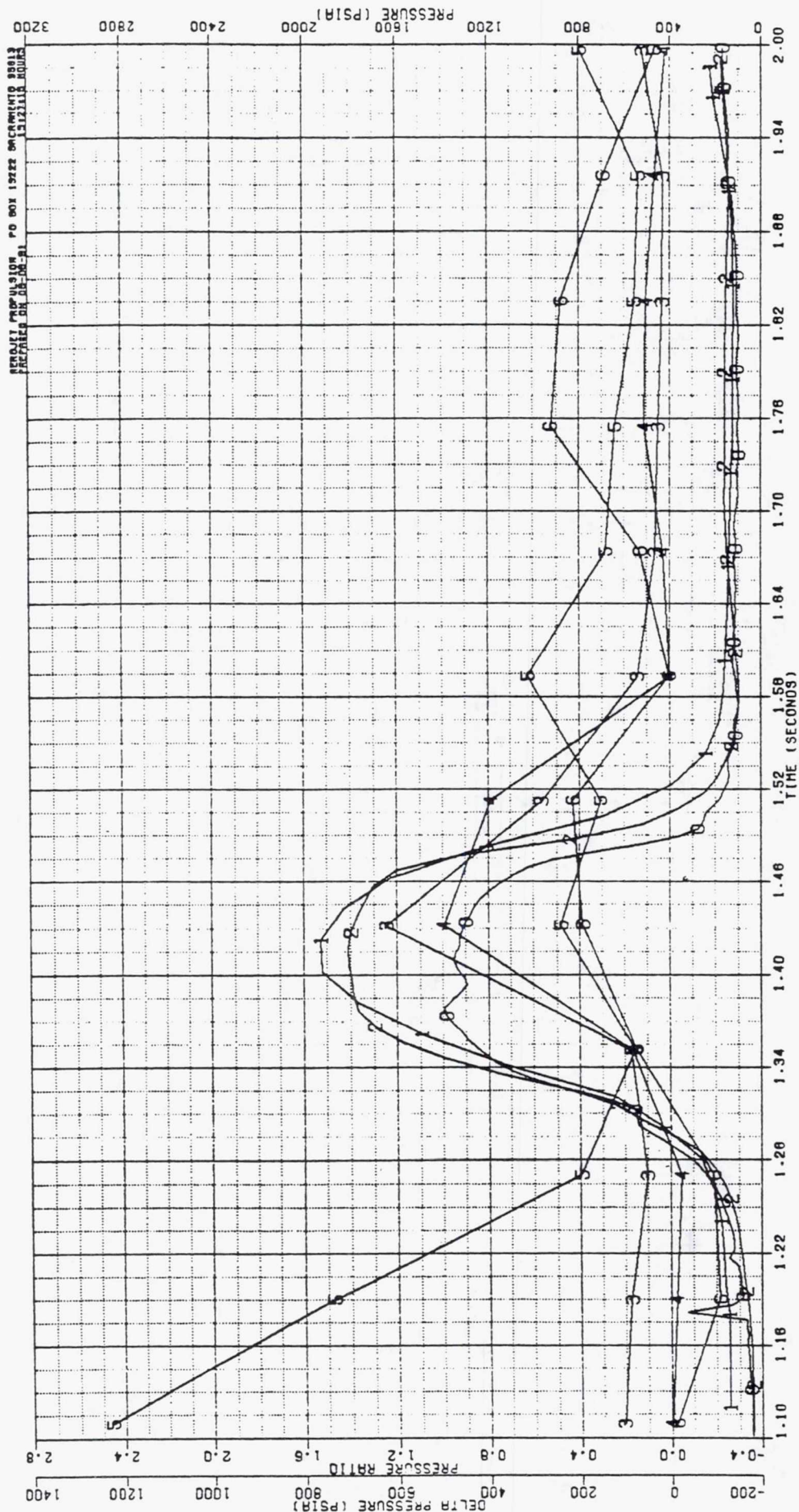


- 0 PC-3 PSIA
- 1 POJ PSIA
- 2 PFJ PSIA
- 3 OPF PSIA
- 4 OPF PSIA
- 5 OP0/PC
- 6 OPF/PC

ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-08-91 AT 1750 HOURS DURATION 1.823 SECONDS
TEST NUMBER KFN7-001-1J-013 TEST STAND E-4



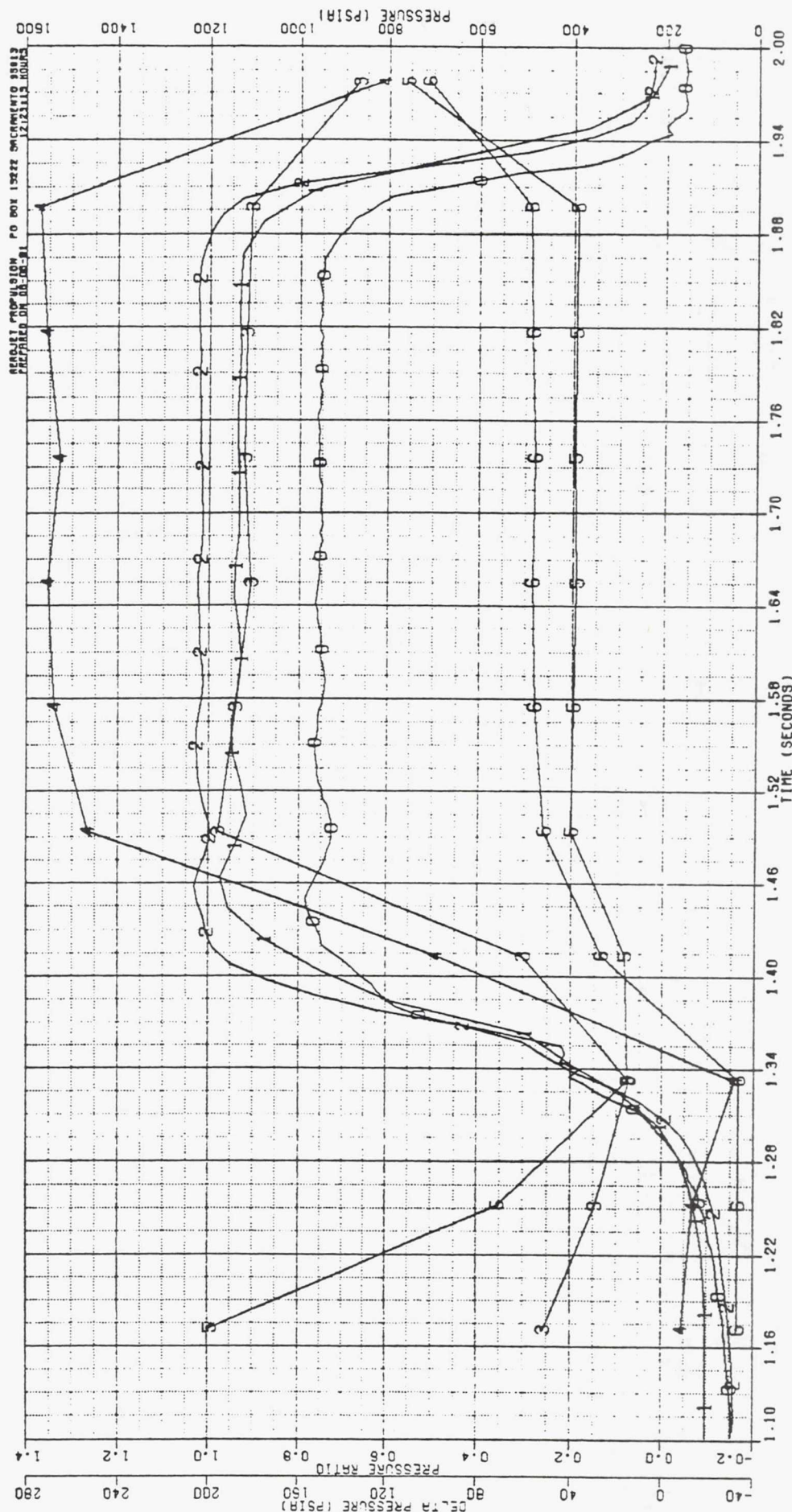


ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-09-91 AT 1110 HOURS DURATION 1.387 SECONDS
TEST NUMBER KFN7-001-1J-014 TEST STAND E-4

GENCORP
AEROJET

- 0 PC-3 PSIA
- 1 POJ PSIA
- 2 PFJ PSIA
- 3 DPO PSIA
- 4 OPF PSIA
- 5 W/P/PC
- 6 OPF/PC

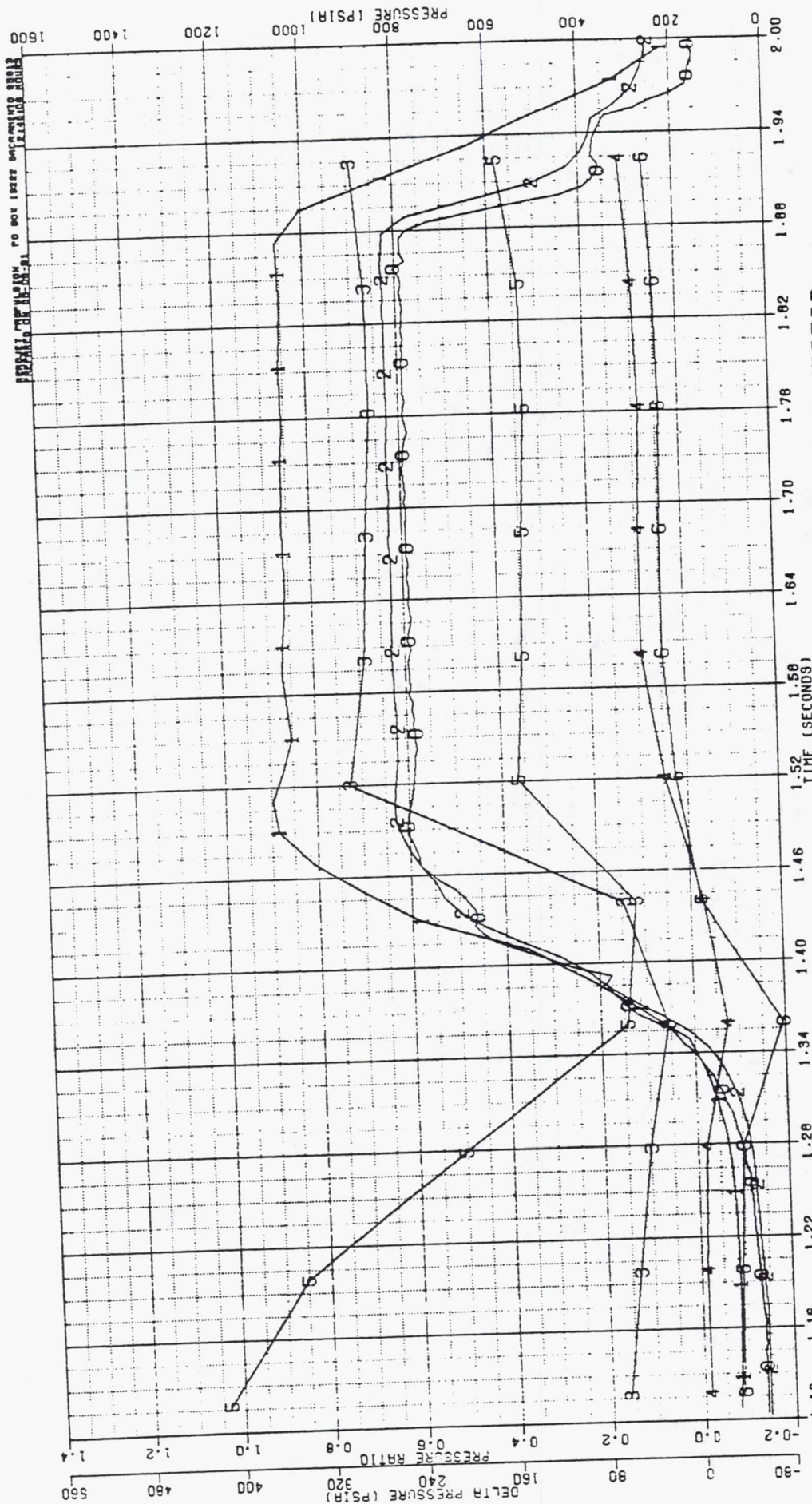


0 PC-3
1 PC-3
2 PC-3
3 PC-3
4 PC-3
5 PC-3
6 PC-3

ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-09-91 AT 1347 HOURS
TEST NUMBER KFN7-001-1J-015
DURATION 1.823 SECONDS
TEST STAND E-4

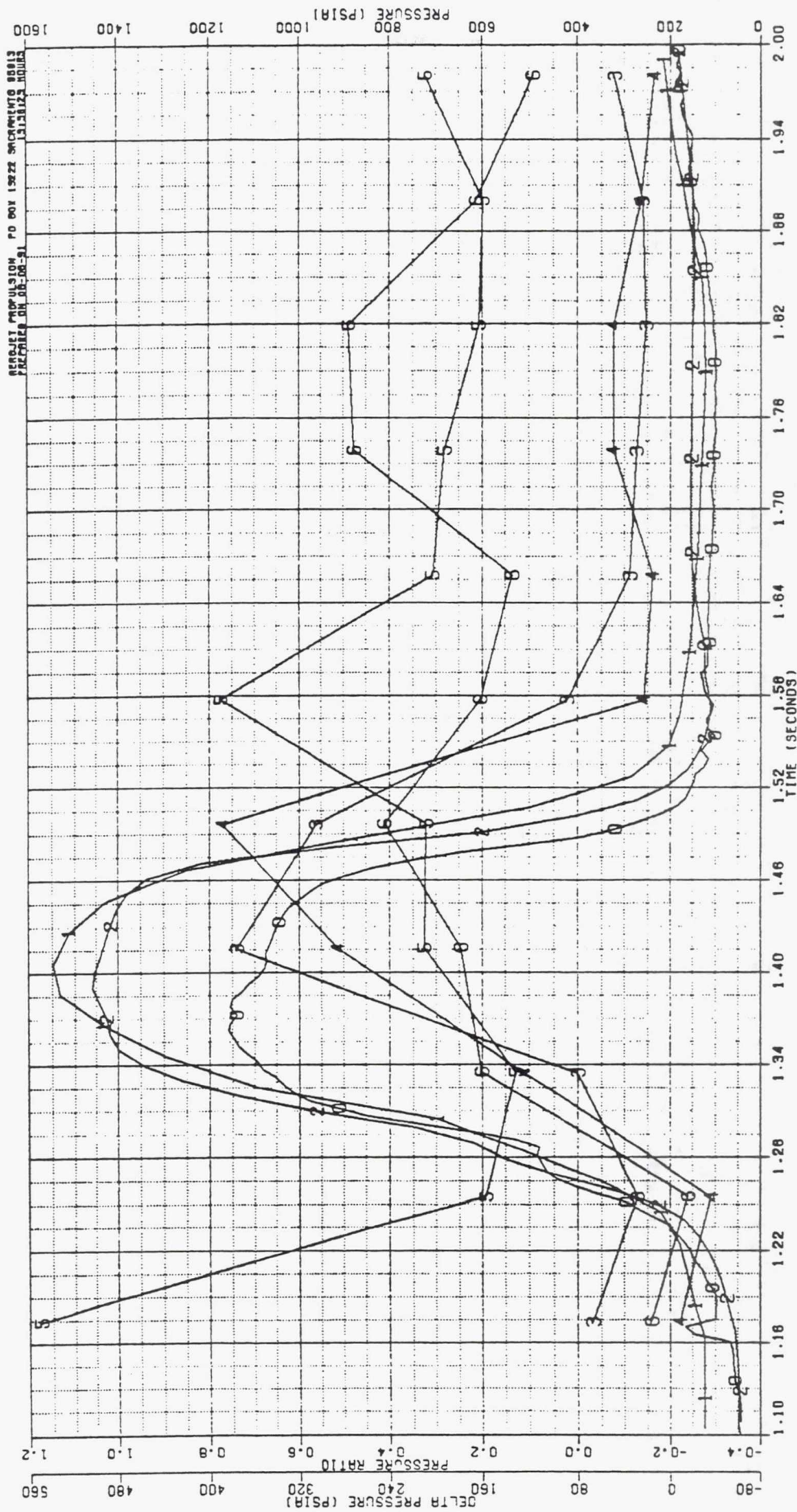
GENCORP
AEROJET



ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-09-91 AT 1553 HOURS DURATION 1.836 SECONDS
TEST NUMBER KFN7-001-1J-017 TEST STAND E-4

GENCORP
AEROJET



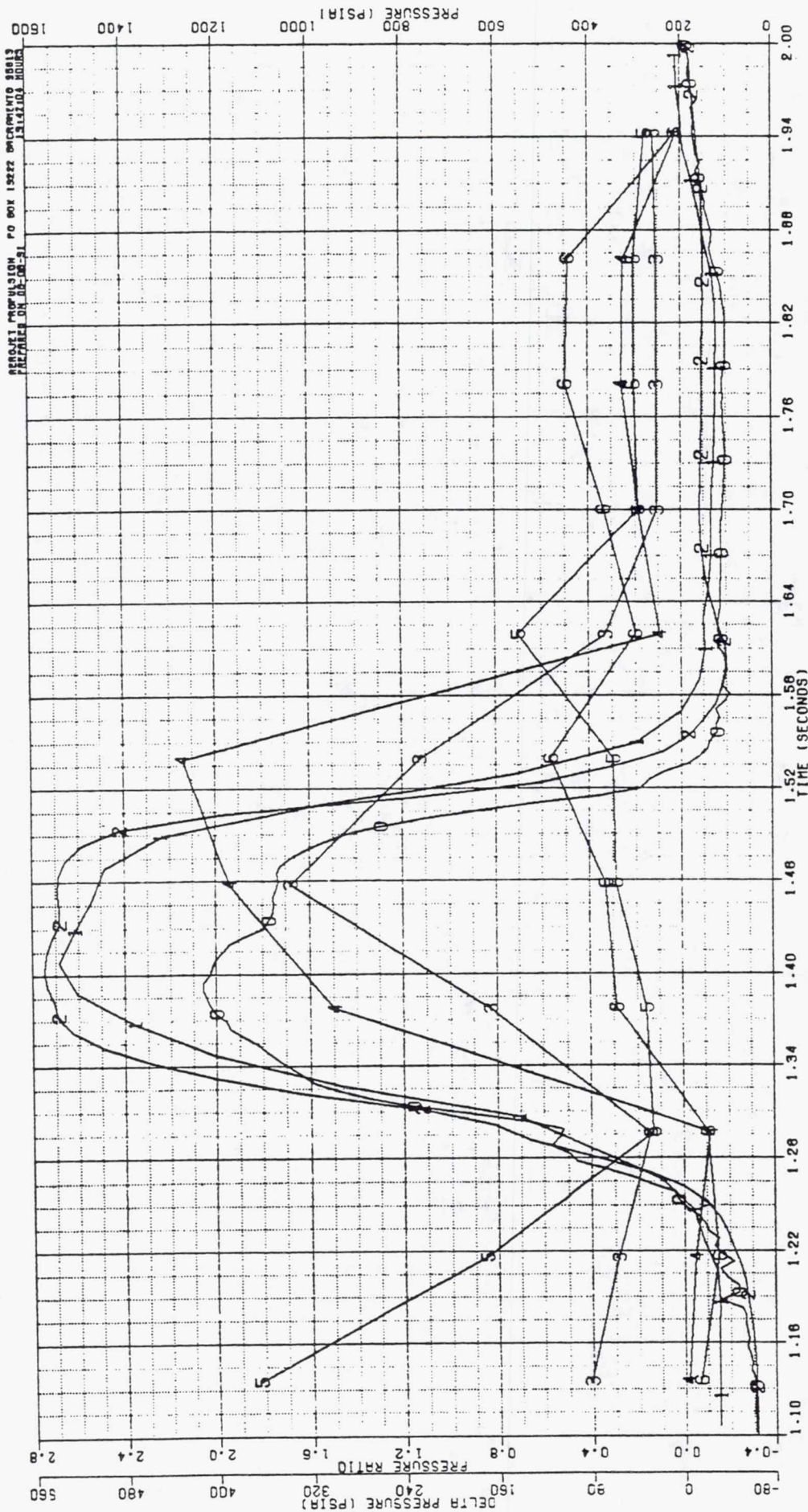
ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-10-91 AT 1105 HOURS DURATION 1.383 SECONDS

TEST NUMBER KFN7-D01-1J-010

TEST STAND E-4

GENCORP
AEROJET



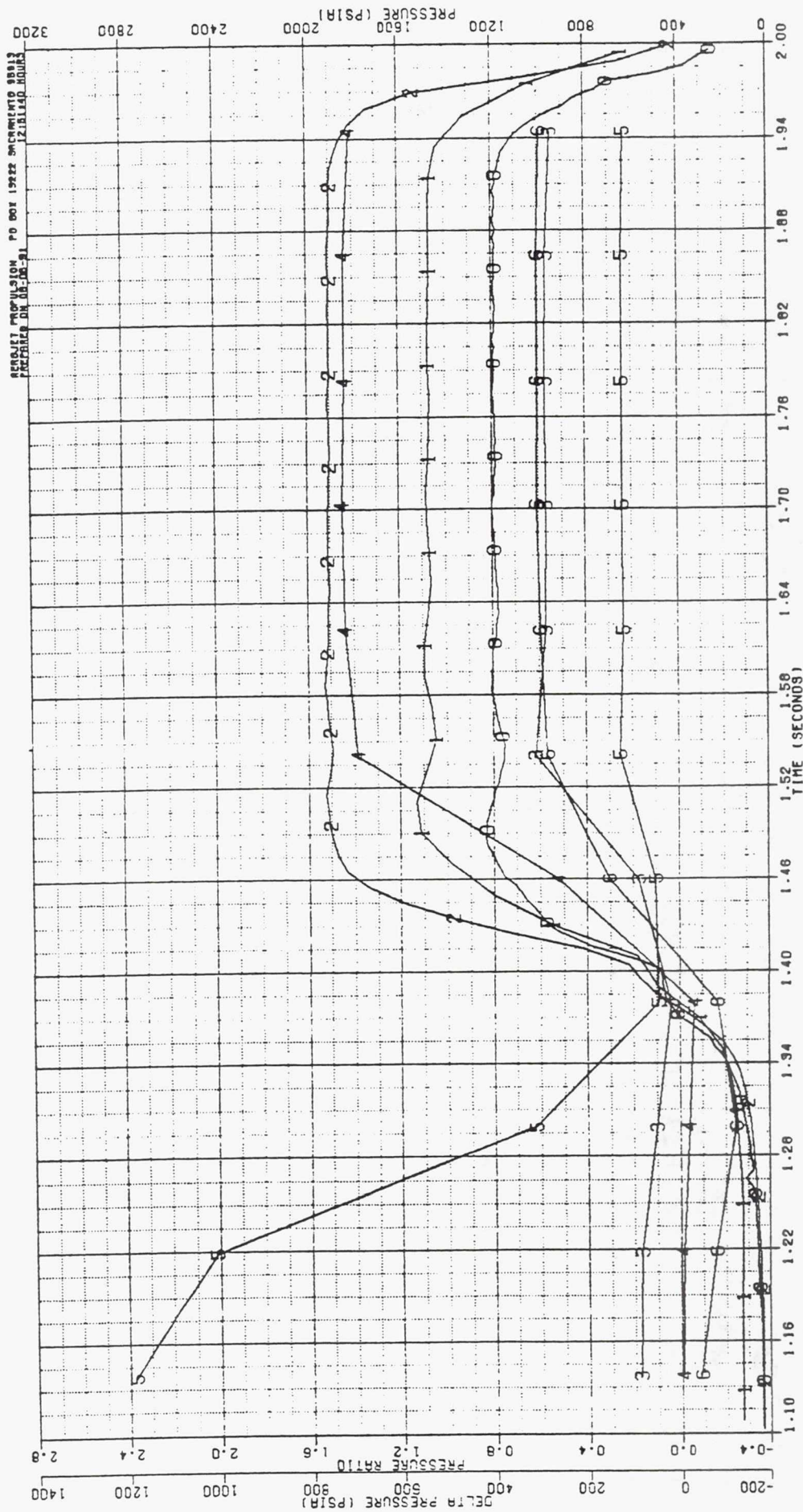
ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-10-91 AT 1341 HOURS DURATION 1.403 SECONDS

TEST NUMBER KFN7-001-1J-019

TEST STAND E-4

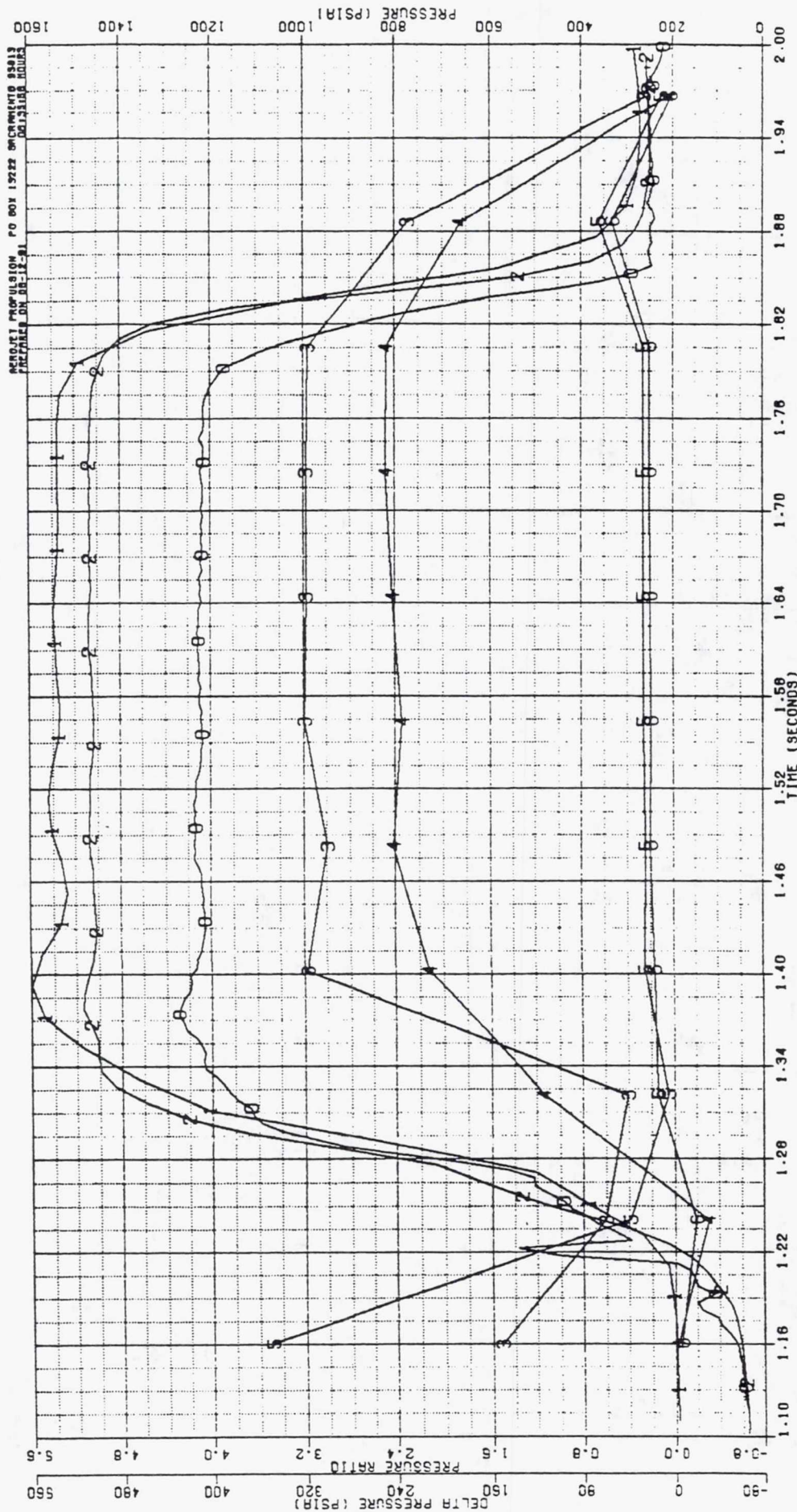
GENCORP
AEROJET



ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-10-91 AT 1455 HOURS DURATION 1.865 SECONDS
TEST NUMBER KFN7-D01-1J-020 TEST STAND E-4

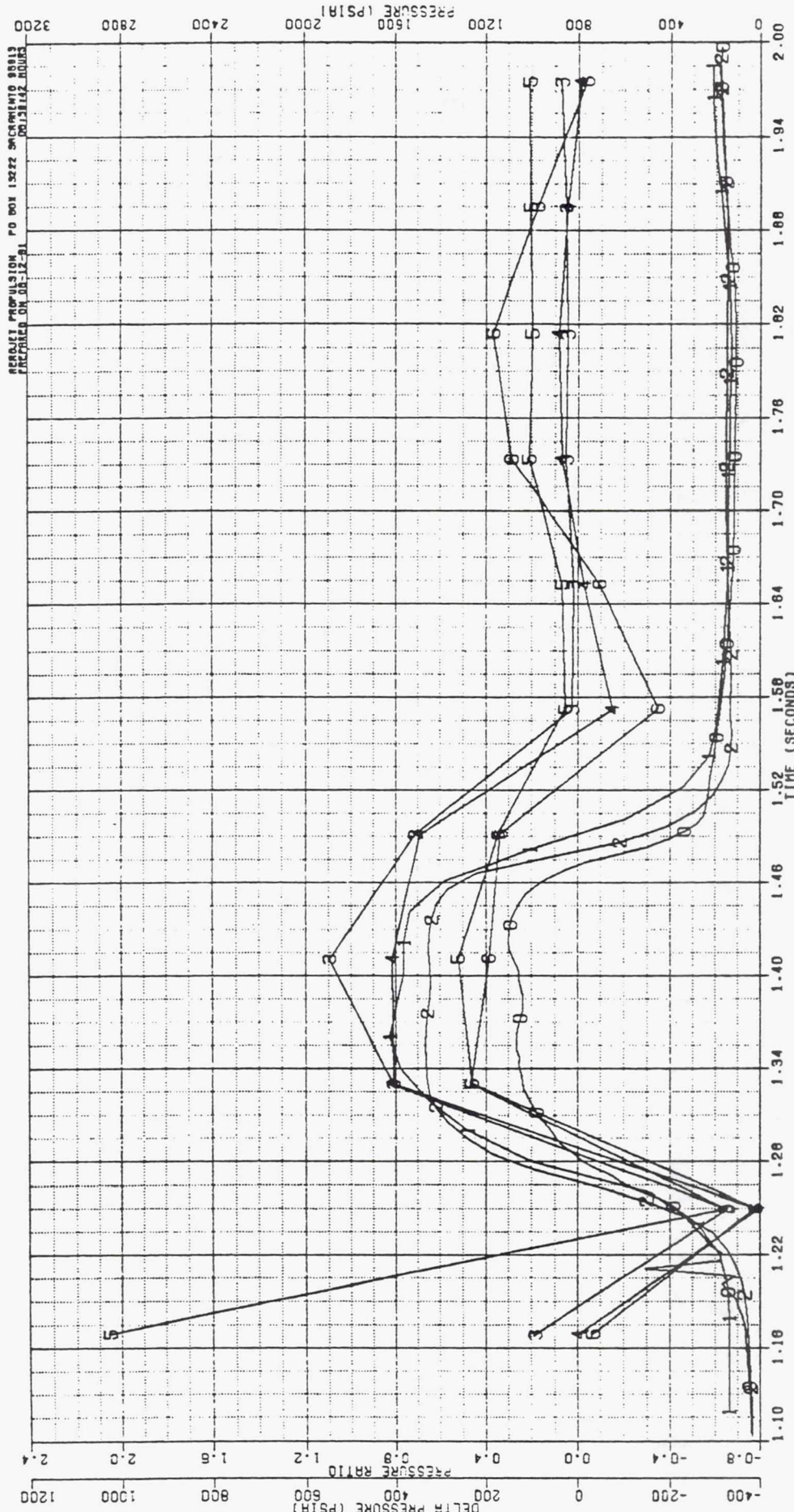
GENCORP
AEROJET



ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-15-91 AT 1342 HOURS DURATION 1.744 SECONDS
TEST NUMBER KFN7-001-1J-021 TEST STAND E-4

GENCORP
AEROJET

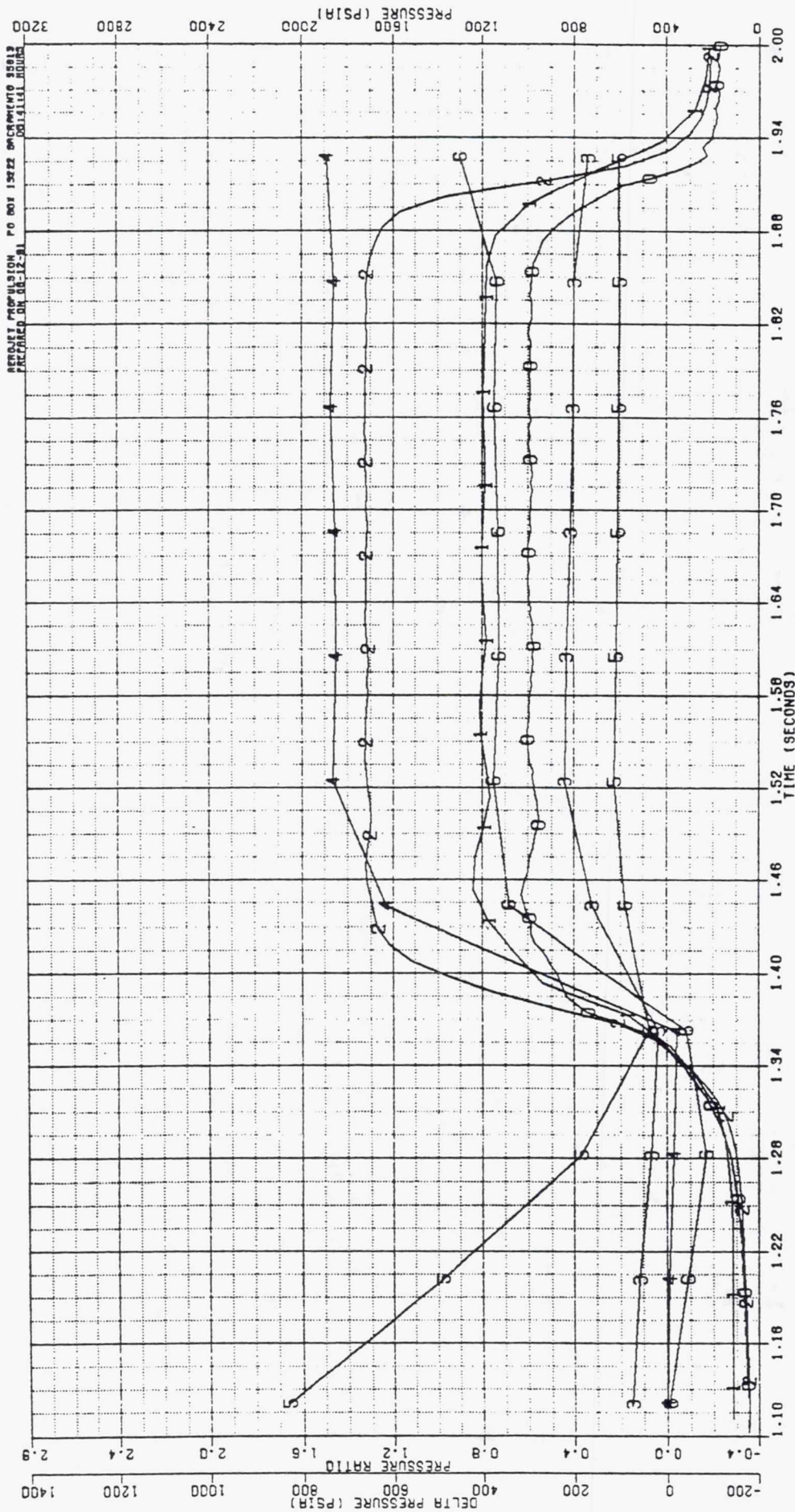


ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-15-91 AT 1439 HOURS DURATION 1.366 SECONDS
TEST NUMBER KFN7-D01-1J-022 TEST STAND E-4

**GENCORP
AEROJET**

0	PC-3	PSIA
1	P0J	PSIA
2	PFJ	PSIA
3	OP0	PSIA
4	OPF	PSIA
5	OP0/PC	
6	OPF/PC	



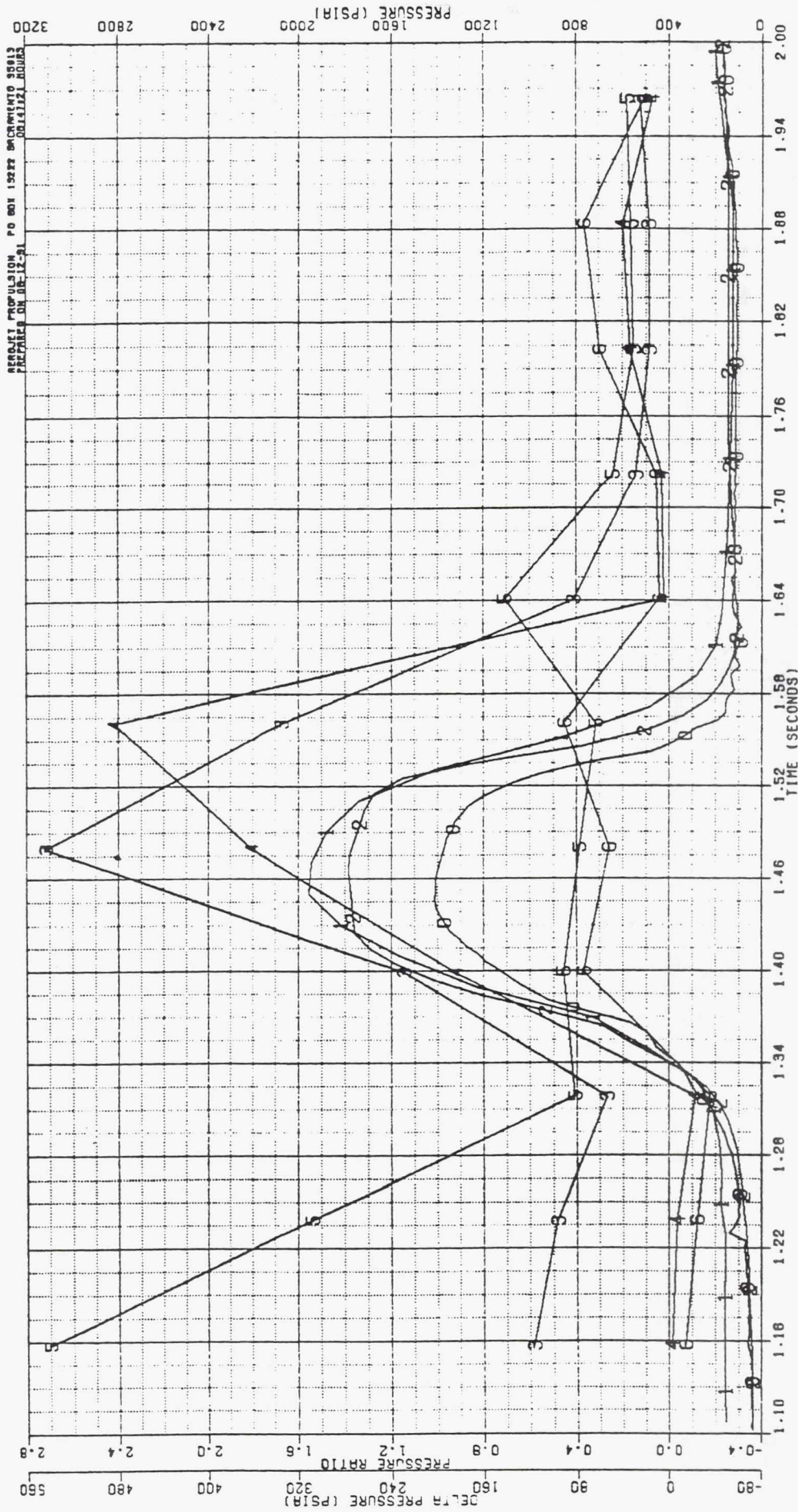
ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-17-91 AT 1000 HOURS DURATION 1.825 SECONDS

TEST NUMBER KFN7-001-1J-023

TEST STAND E-4

GENCORP
AEROJET



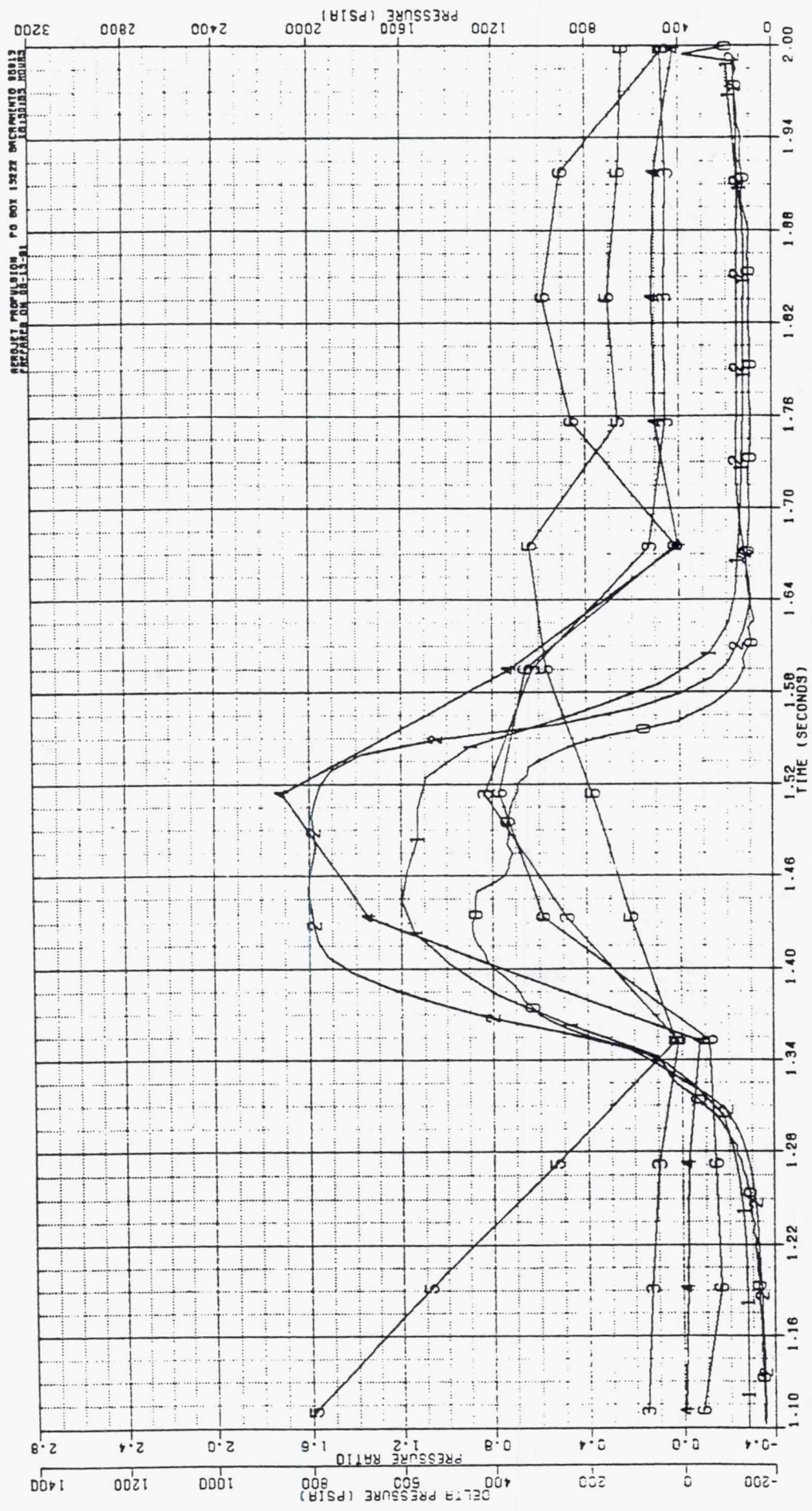
0 PC-3
1 PC-4
2 PC-5
3 PC-6
4 PC-7
5 PC-8

PSIA
PSIA
PSIA
PSIA
PSIA
PSIA

ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-17-91 AT 1330 HOURS
TEST NUMBER KFN7-D01-1J-025
DURATION 1.425 SECONDS
TEST STAND E-4

GENCORP
AEROJET

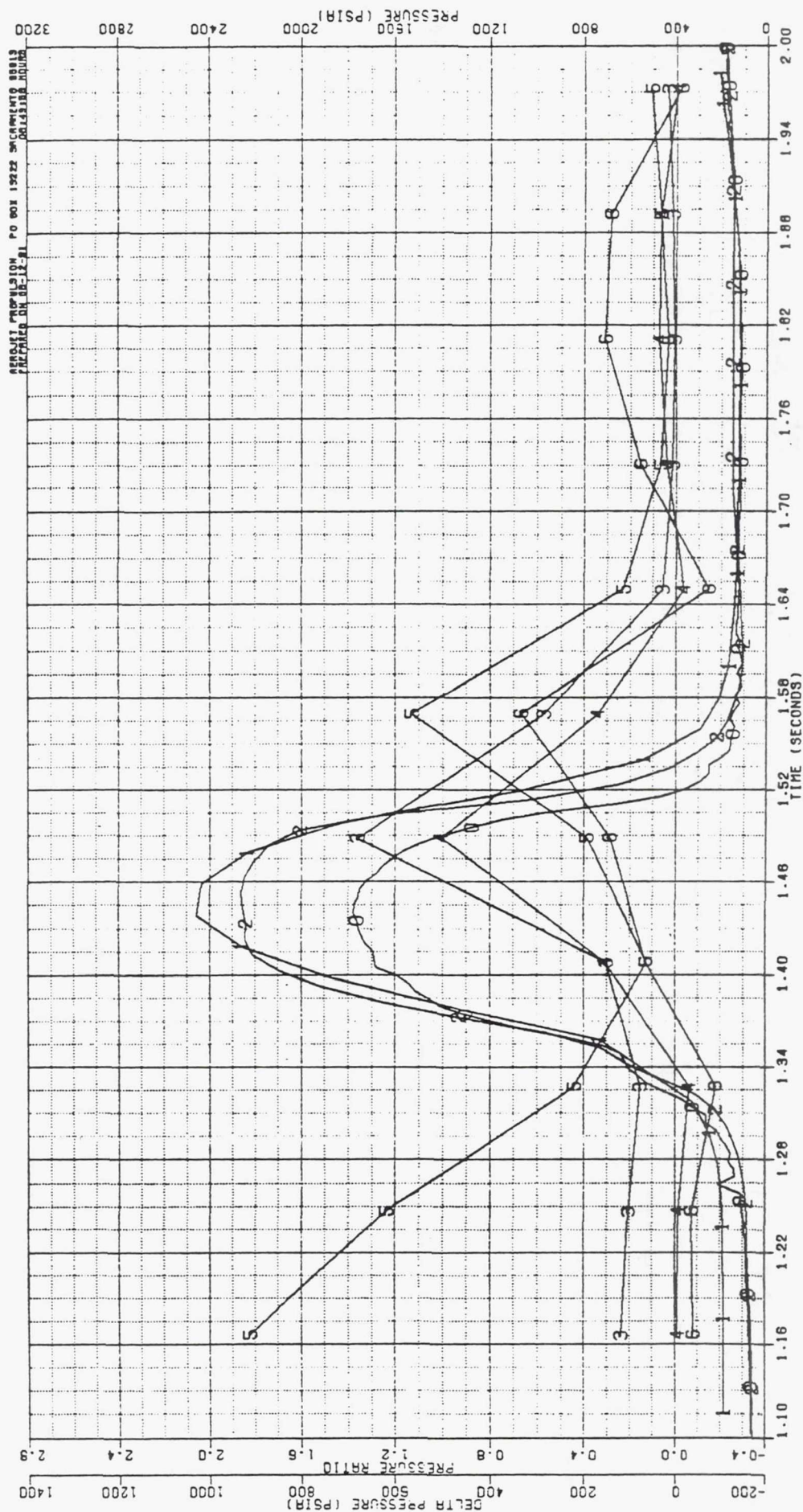


- 0 PC-3 PSIA
- 1 POJ PSIA
- 2 PFJ PSIA
- 3 OP0 PSIA
- 4 OPF PSIA
- 5 OP0/PC
- 6 OPF/PC

ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-22-91 AT 1315 HOURS DURATION 1.464 SECONDS
 TEST NUMBER KFN7-D01-1J-026 TEST STAND E-4

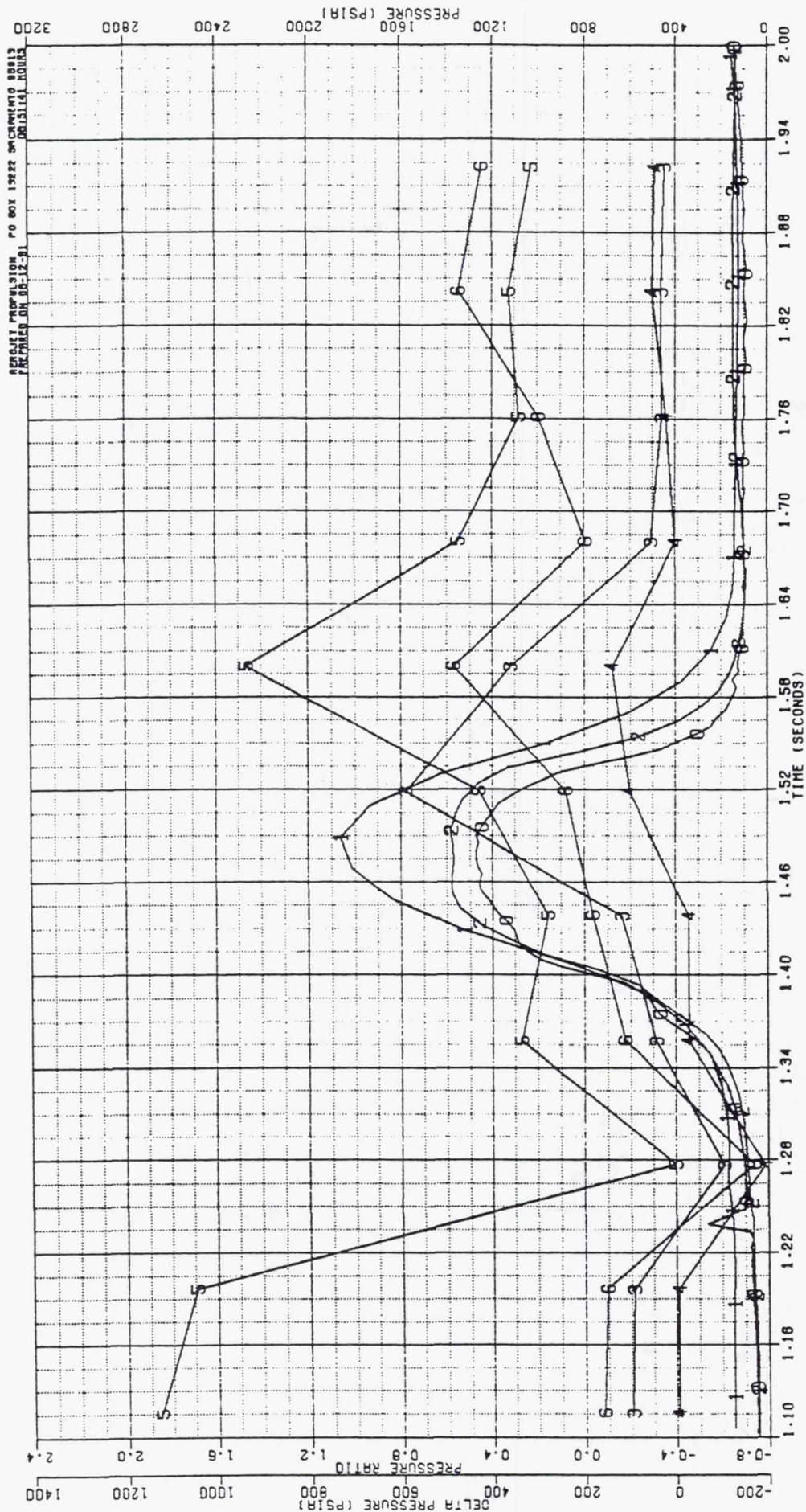
GENCORP
AEROJET



ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-23-91 AT 1056 HOURS
 TEST NUMBER KFN7-D01-1J-027
 DURATION 1.410 SECONDS
 TEST STAND E-4

GENCORP
AEROJET

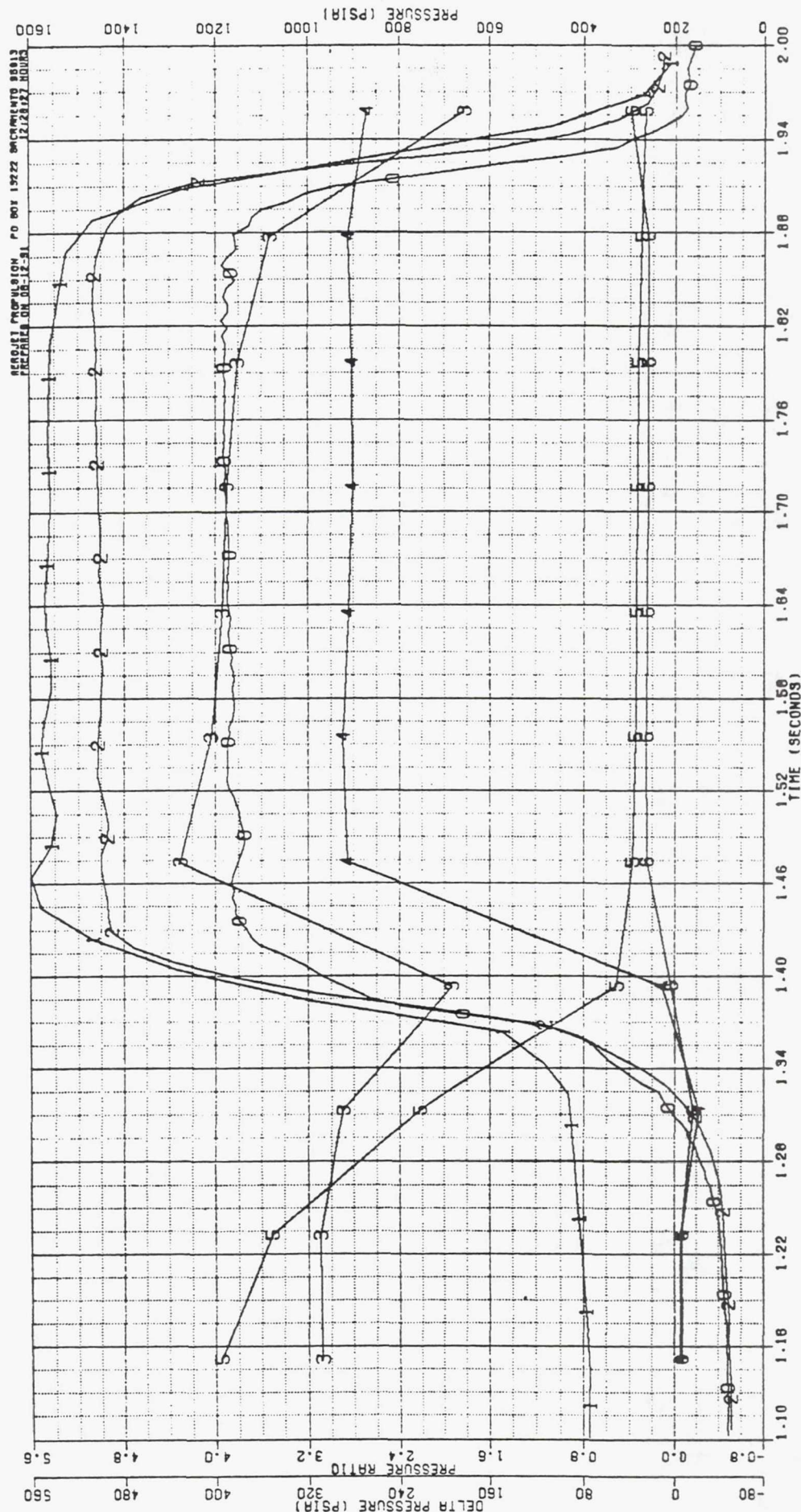


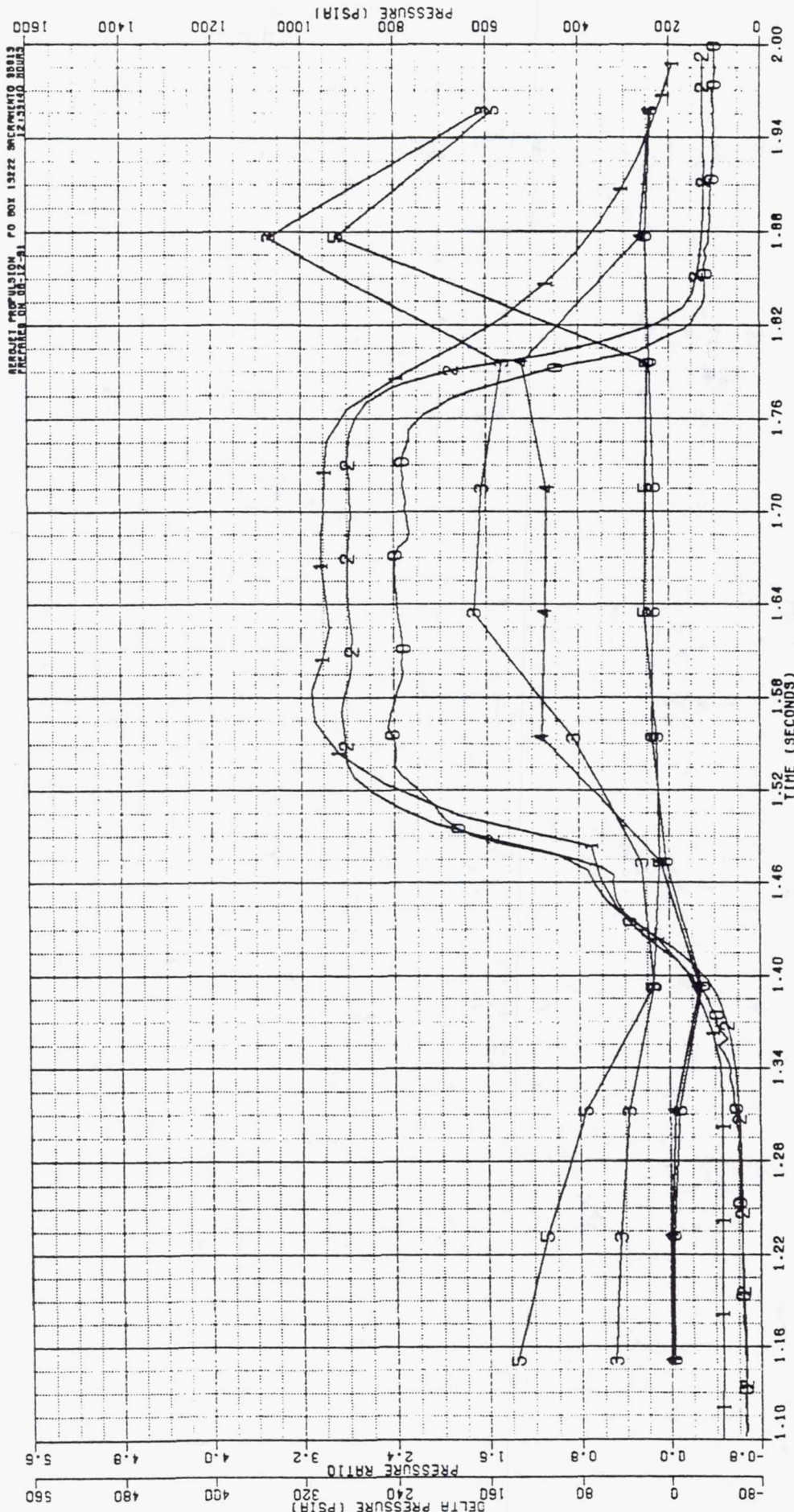
ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-23-91 AT 1305 HOURS DURATION 1.436 SECONDS

TEST NUMBER KFN7-001-1J-028 TEST STAND E-4

GENCORP
AEROJET

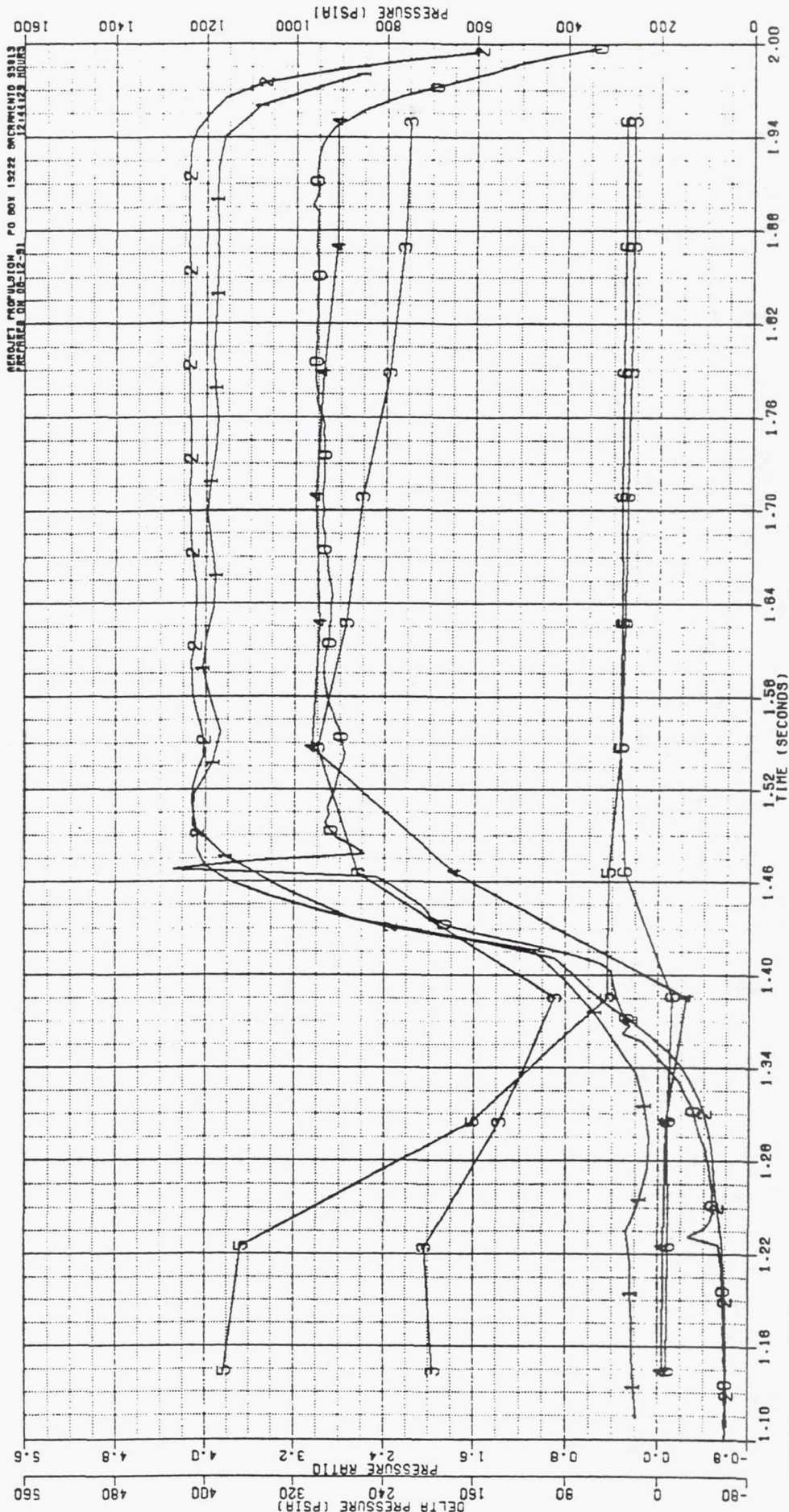




ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 04-30-91 AT 1441 HOURS DURATION 1.693 SECONDS
TEST NUMBER KFN7-001-1J-030 TEST STAND E-4

GENCORP
AEROJET



ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

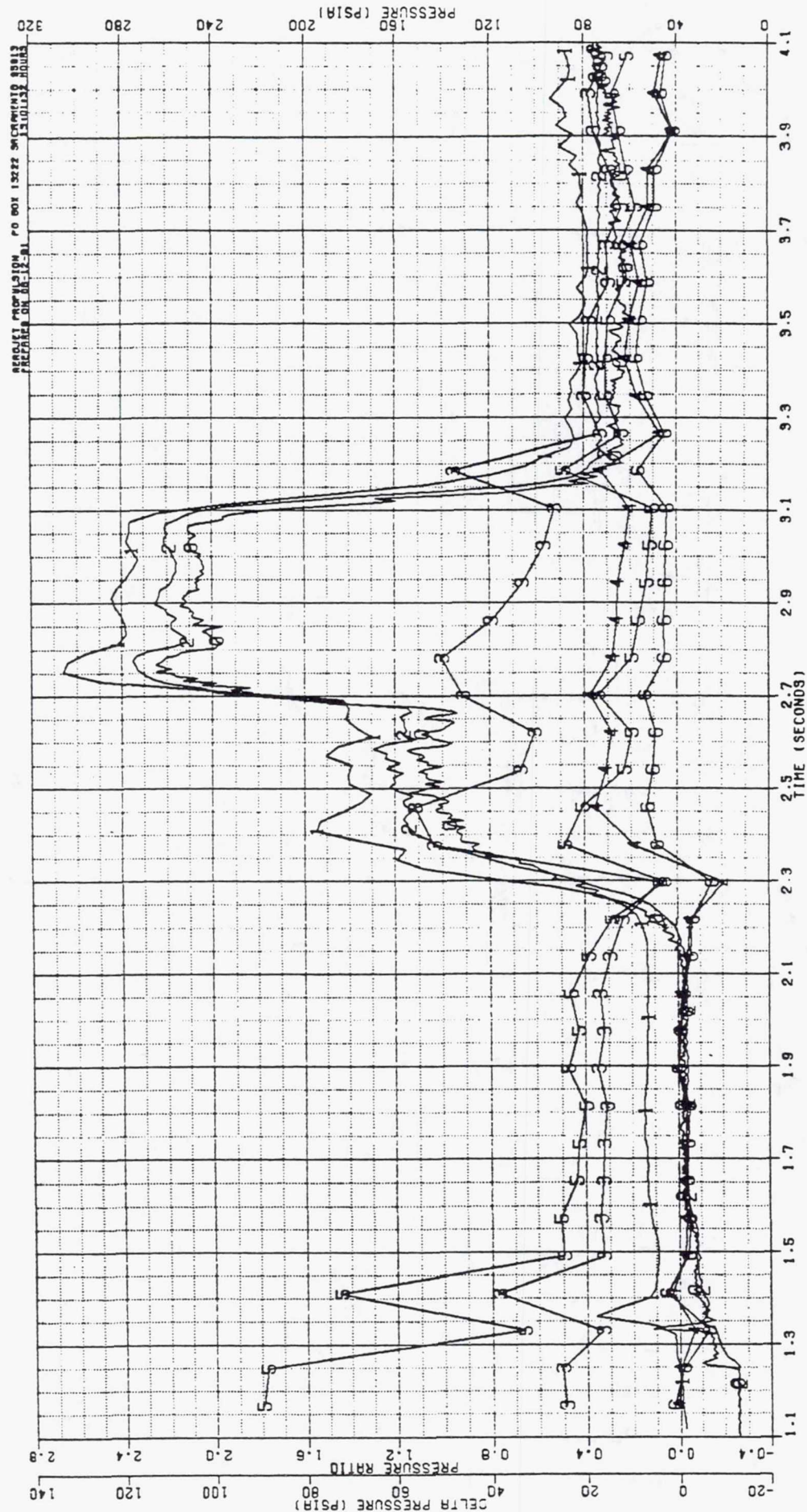
TEST DATE 05-01-91 AT 1102 HOURS DURATION 1.904 SECONDS

TEST NUMBER KFN7-001-1J-031

TEST STAND E-4

GENCORP
AEROJET

0 PC-3 PSIA
 1 POJ PSIA
 2 PFJ PSIA
 3 DPO PSIA
 4 DPO PSIA
 5 DPO/PC
 6 DPO/PC

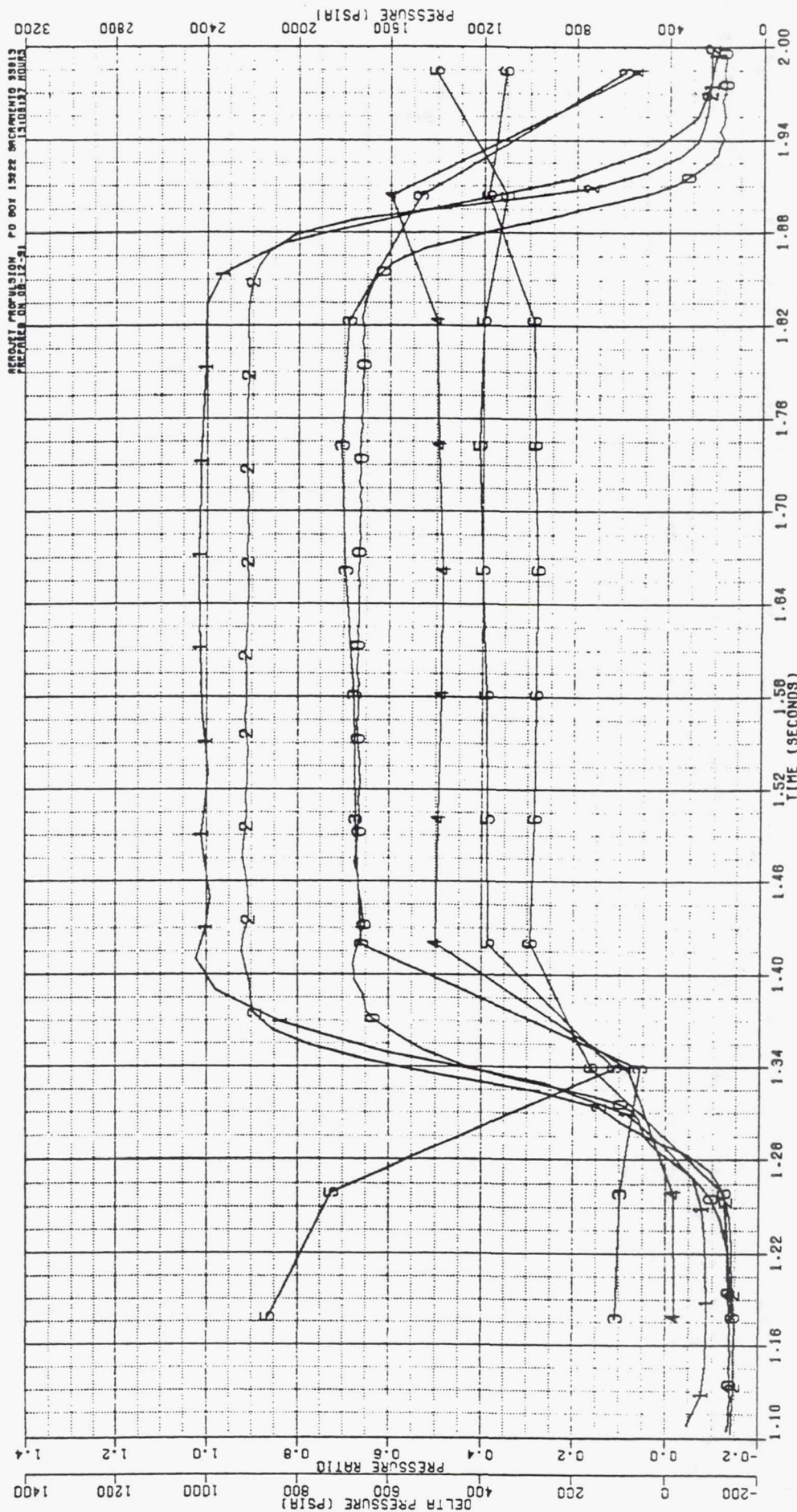


ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 05-01-91 AT 1618 HOURS DURATION 3.016 SECONDS
 TEST NUMBER KFN7-D01-1J-036 TEST STAND E-4



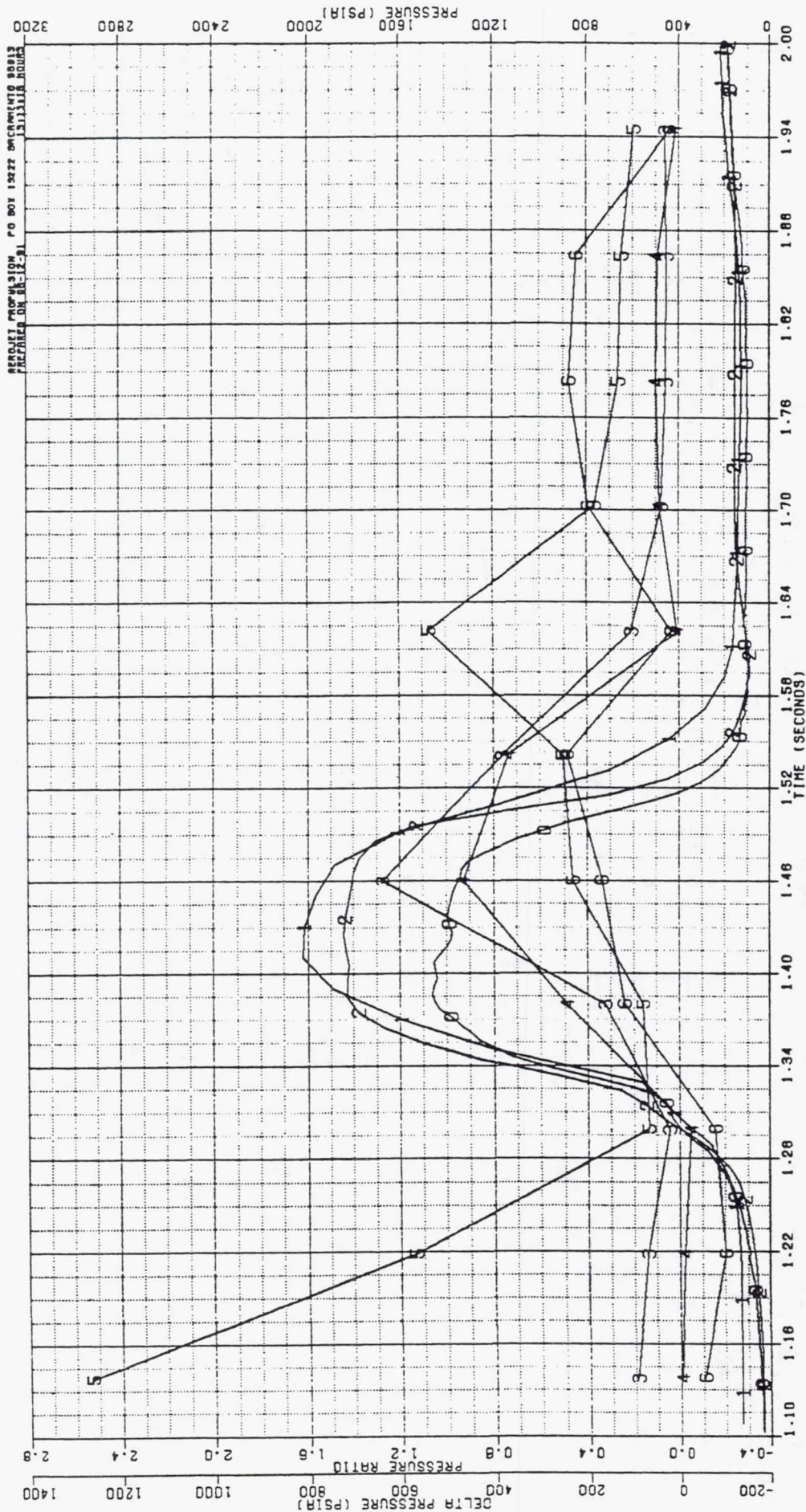
- 0 PC-3 PSIA
- 1 POJ PSIA
- 2 PFJ PSIA
- 3 DPO PSIA
- 4 OPF PSIA
- 5 DPO/PC
- 6 OPF/PC



ROCCIO SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 05-02-91 AT 1336 HOURS DURATION 1.805 SECONDS
 TEST NUMBER KFN7-001-1J-037 TEST STAND E-4

GENCORP
AEROJET



ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 05-02-91 AT 1452 HOURS - DURATION 1.402 SECONDS

TEST NUMBER KFN7-001-1J-030

TEST STAND E-4

GENCORP
AEROJET

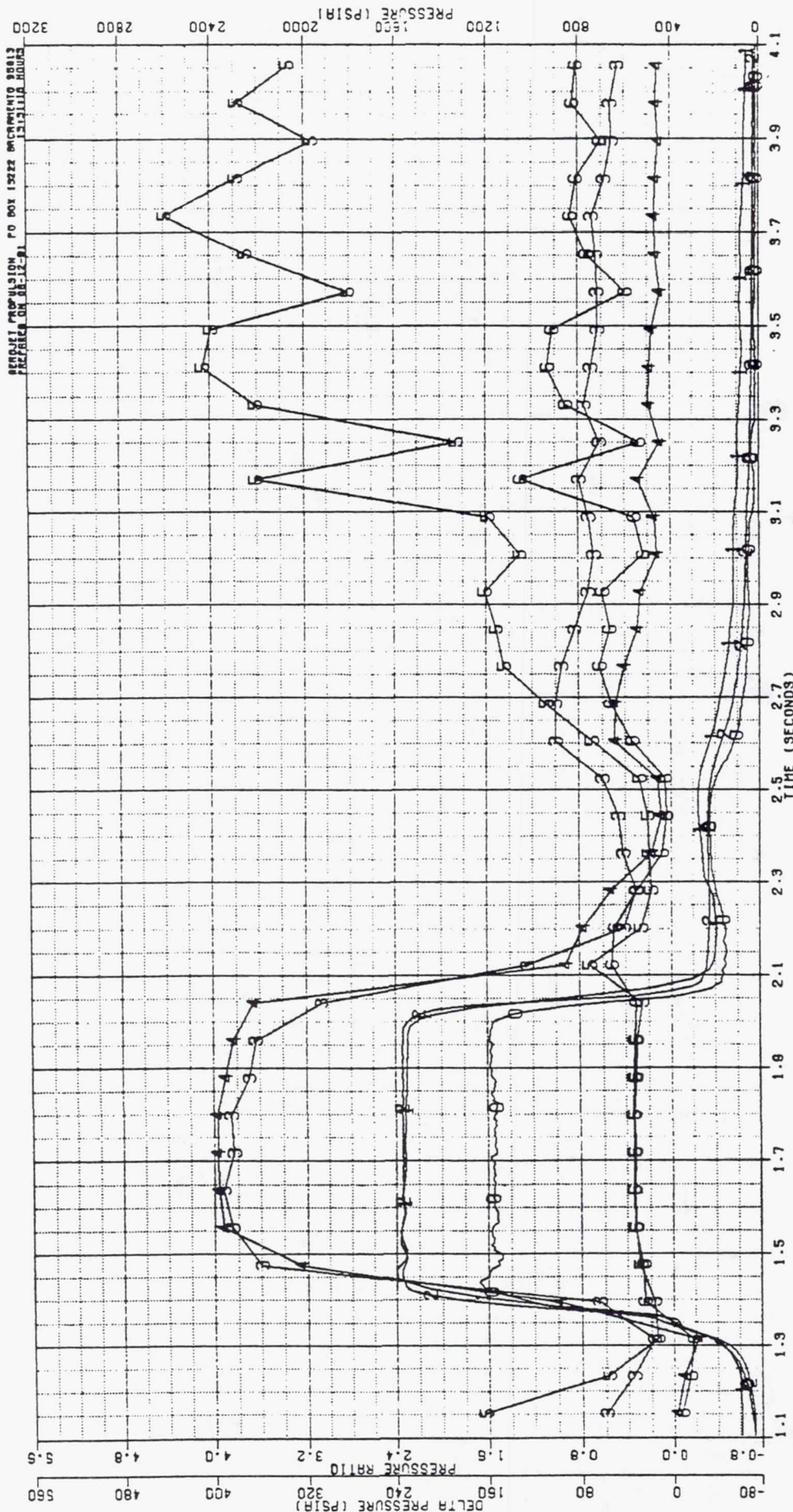
0 PC-3 PSIA
 1 POJ PSIA
 2 PFJ PSIA
 3 DPO PSIA
 4 DPF PSIA
 6 DPO/PC
 6 DPF/PC

ROCCO SUBSCALE INJECTOR
PERFORMANCE PARAMETERS

TEST DATE 05-03-91 AT 1120 HOURS DURATION 1.594 SECONDS
TEST NUMBER KFN7-D01-1J-039 TEST STAND E-4

**GENCORP
AEROJET**

0	PC-3	PS1A
1	PDJ	PS1A
2	PFJ	PS1A
3	OP0	PS1A
4	OPF	PS1A
5	OP0/PC	
6	OPF/PC	



ROCCID SUBSCALE INJECTOR PERFORMANCE PARAMETERS

TEST DATE 05-03-91 AT 1314 HOURS DURATION 1.943 SECONDS
TEST NUMBER KFN7-001-1J-040 TEST STAND E-4

GENCORP
AEROJET

0 PC-3 PSIA
1 POJ PSIA
2 PFJ PSIA
3 DPF PSIA
4 DPF PSIA
5 DPF/PC
6 DPF/PC

APPENDIX B

TIME SERIES, AMPLITUDE AND FREQUENCY EVOLUTION, AND
POWER SPECTRAL ANALYSIS OF CHAMBER PRESSURE
FOR ALL UNSTABLE-COMBUSTION TESTS

INDEX OF TEST DATA PLOTS

Page No.

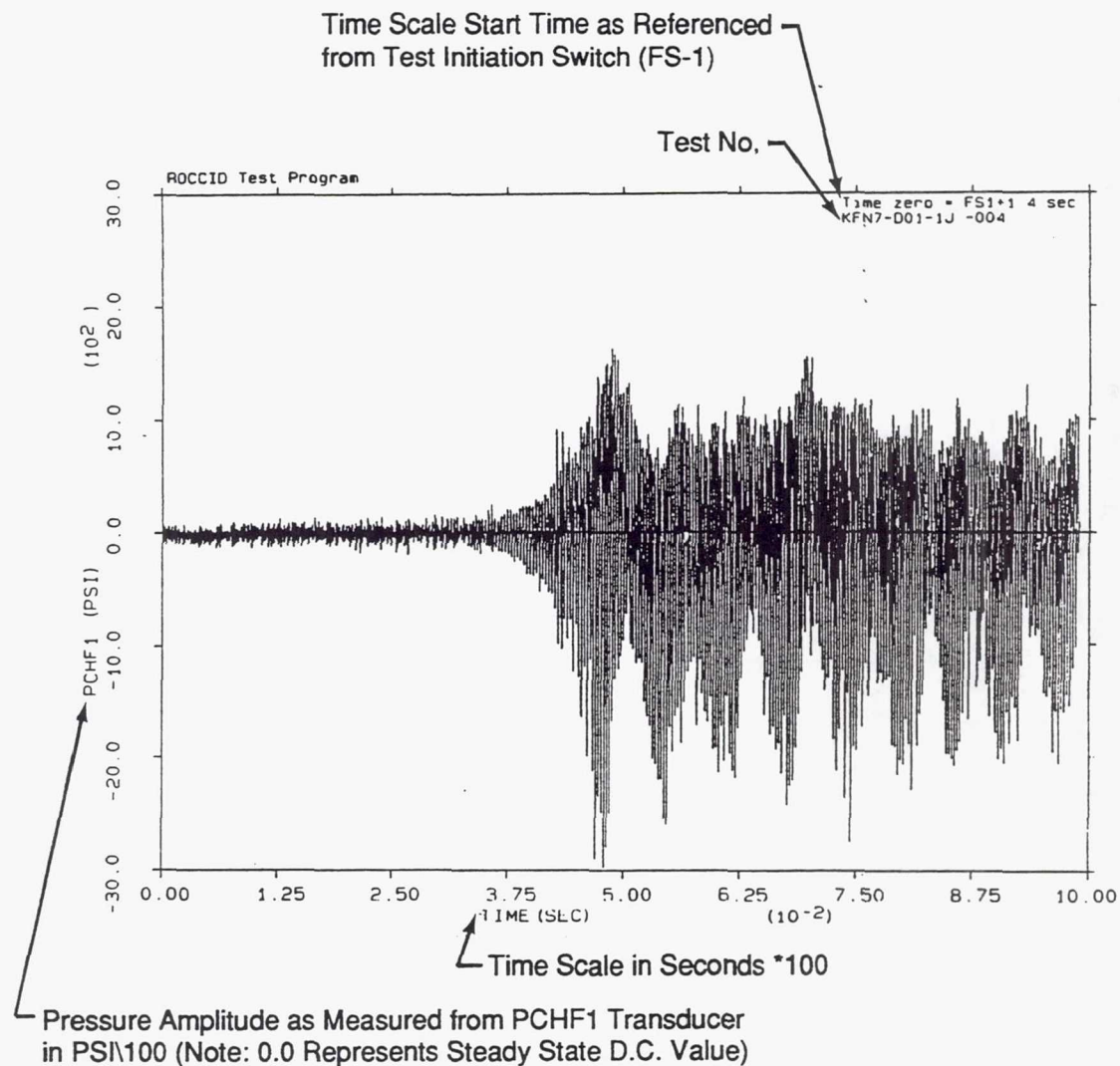
B-3 Thru B-5	Foreword
B-6 Thru B-8	Data From Test No. KFN7-D01-1J-004
B-9 Thru B-11	Data From Test No. KFN7-D01-1J-014
B-12 Thru B-14	Data From Test No. KFN7-D01-1J-018
B-15 Thru B-17	Data From Test No. KFN7-D01-1J-019
B-18 Thru B-20	Data From Test No. KFN7-D01-1J-021
B-21 Thru B-23	Data From Test No. KFN7-D01-1J-022
B-24 Thru B-26	Data From Test No. KFN7-D01-1J-025
B-27 Thru B-29	Data From Test No. KFN7-D01-1J-026
B-30 Thru B-32	Data From Test No. KFN7-D01-1J-027
B-33 Thru B-35	Data From Test No. KFN7-D01-1J-028
B-36 Thru B-38	Data From Test No. KFN7-D01-1J-029
B-39 Thru B-41	Data From Test No. KFN7-D01-1J-030
B-42 Thru B-44	Data From Test No. KFN7-D01-1J-037
B-45 Thru B-47	Data From Test No. KFN7-D01-1J-038
B-48 Thru B-50	Data From Test No. KFN7-D01-1J-039
B-51 Thru B-53	Data From Test No. KFN7-D01-1J-040

Note: See Foreword (next page) for explanation of information contained in the 3 plot set for each test.

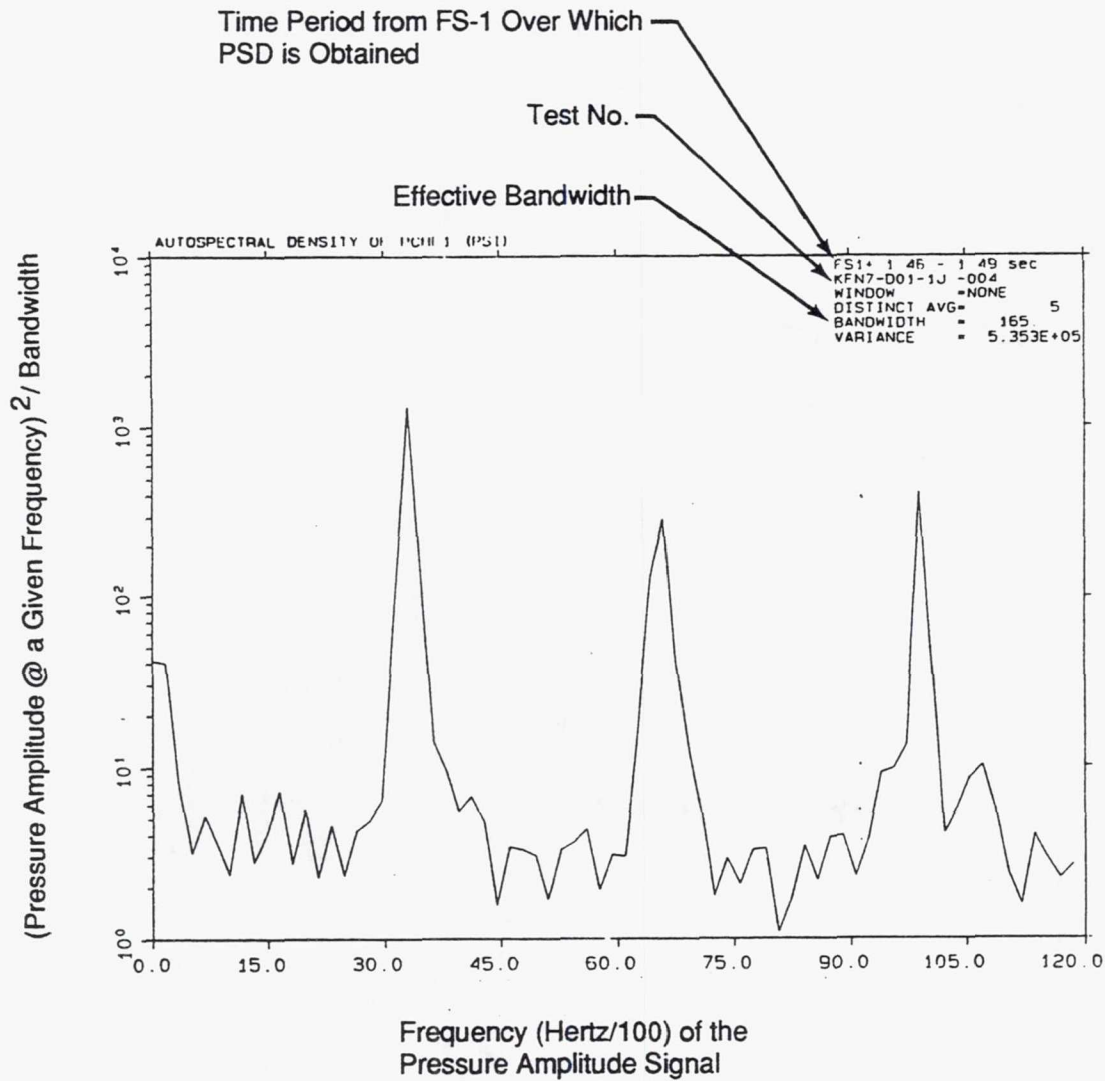
FOREWORD

Unstable operation was observed during 16 of the 27 valid tests conducted during the ROCCID validation test program. For each of these unstable tests, the following information is contained in this appendix:

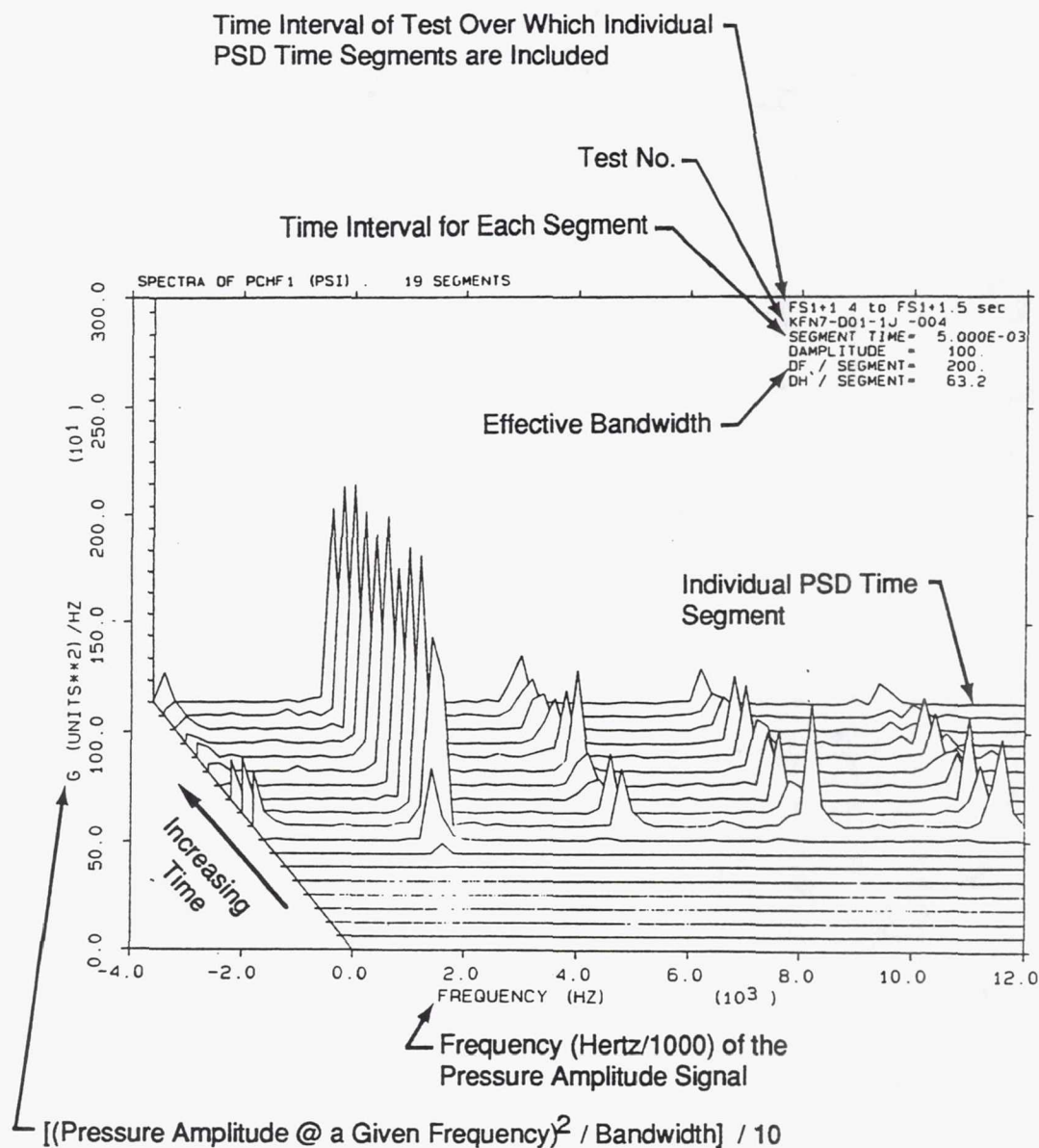
- (1) High Frequency Chamber Pressure Transducer playback of the pressure amplitude versus time prior to and during the observed unstable combustion event. Sample format for this plot is as follows:



- (2) Power Spectral Density (PSD) analysis of the high frequency pressure amplitude recorded signal. Sample format for this plot is as follows:

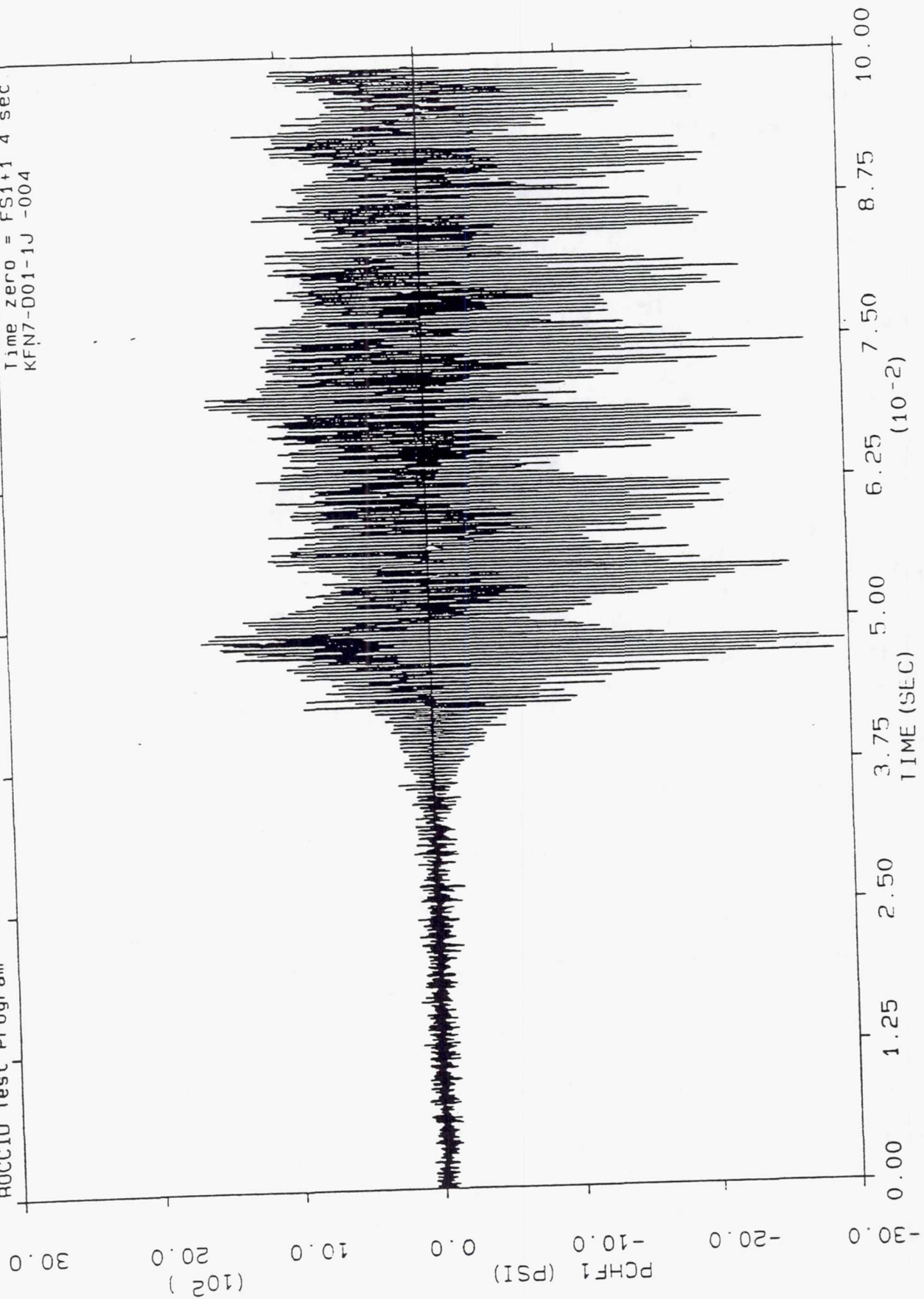


- (3) Power Spectral Analysis of the high frequency pressure amplitude signal. Sample format for this pot is as follows:



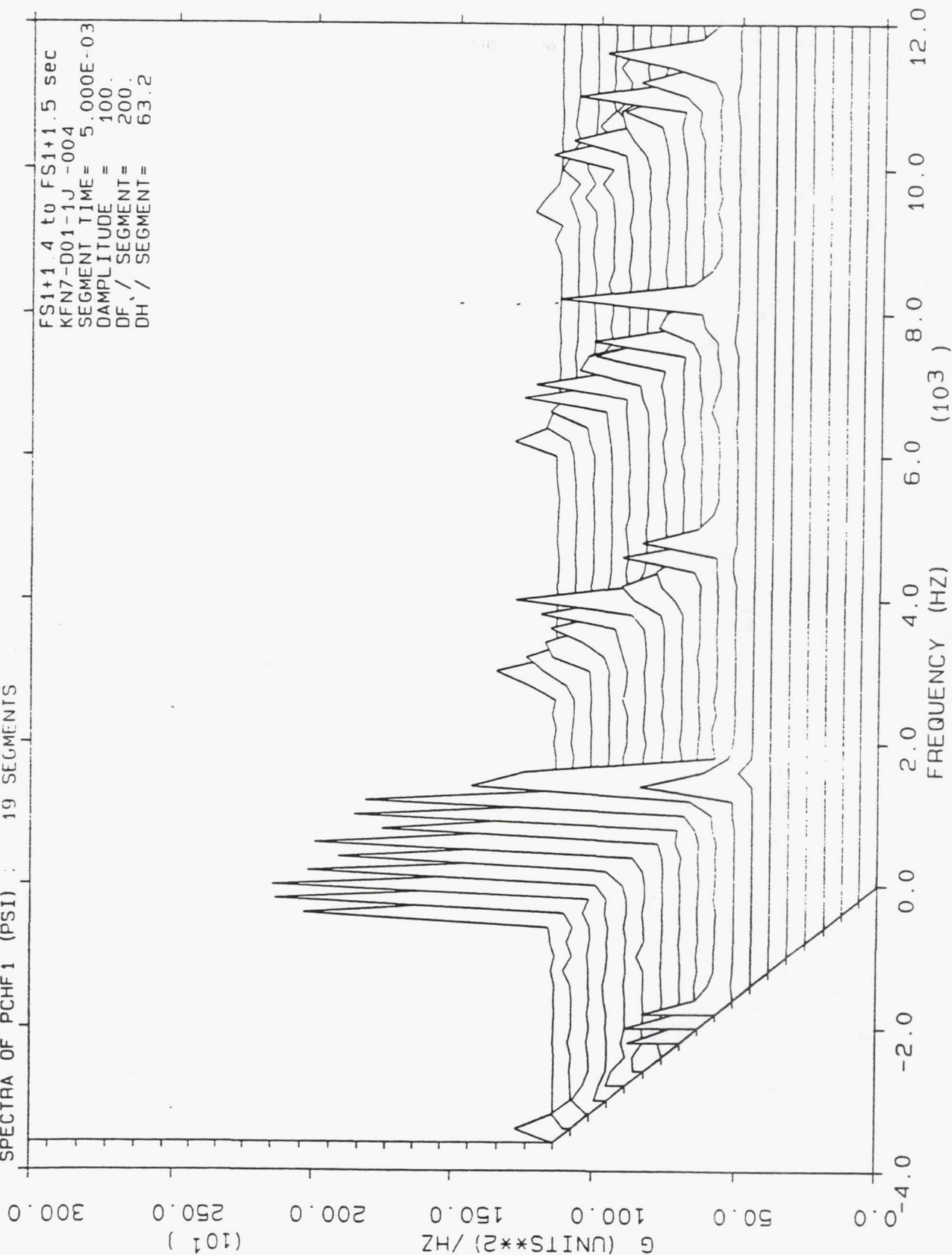
ROCCID Test Program

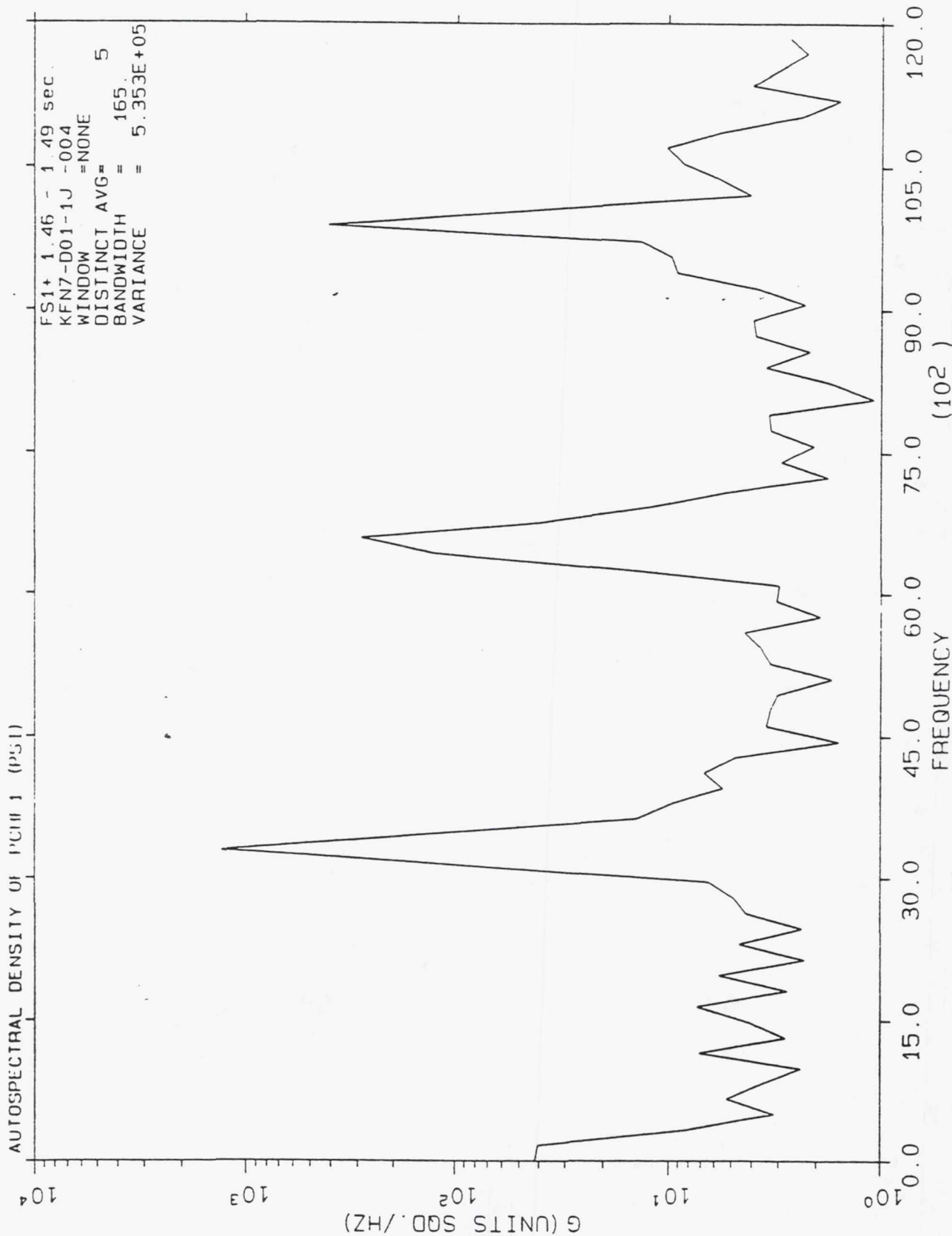
Time zero = FS1+1 4 sec
KFN7-D01-1J -004



SPECTRA OF PCHF1 (PSI) : 19 SEGMENTS

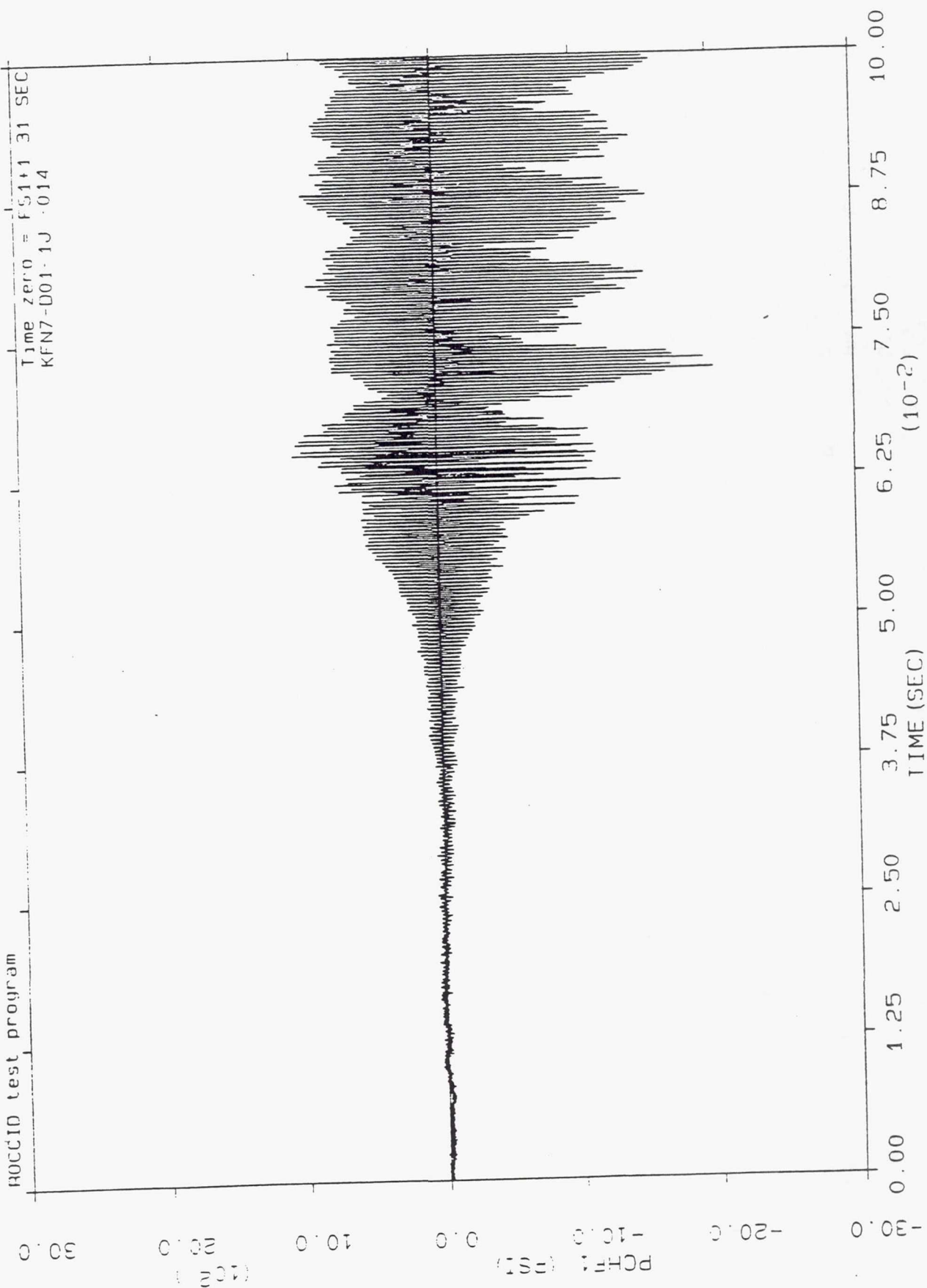
FS1+1.4 to FS1+1.5 sec
 KFN7-D01-1J -004
 SEGMENT TIME= 5.000E-03
 DAMPLITUDE = 100.
 DF. / SEGMENT= 200.
 DH. / SEGMENT= 63.2





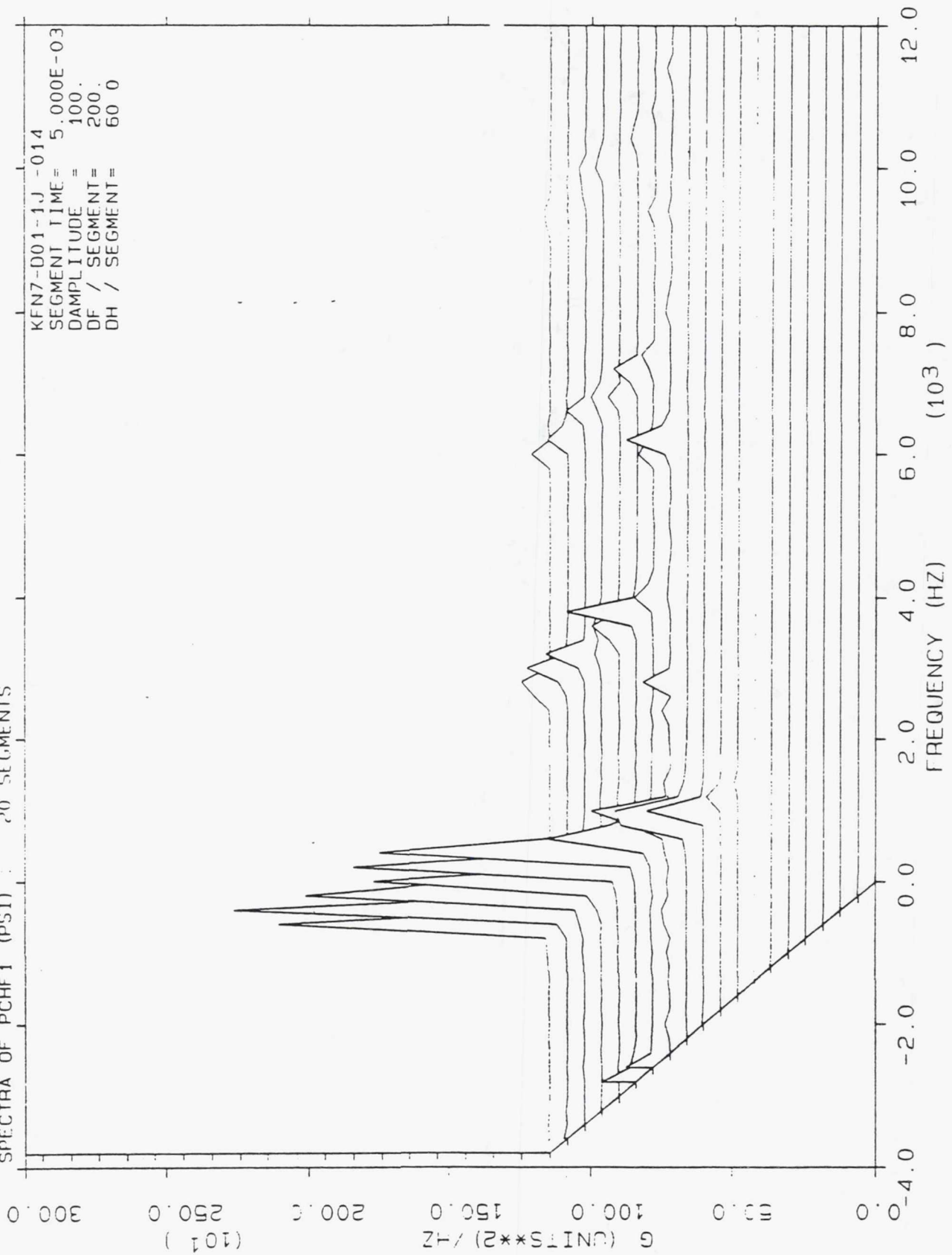
ROCCID test program

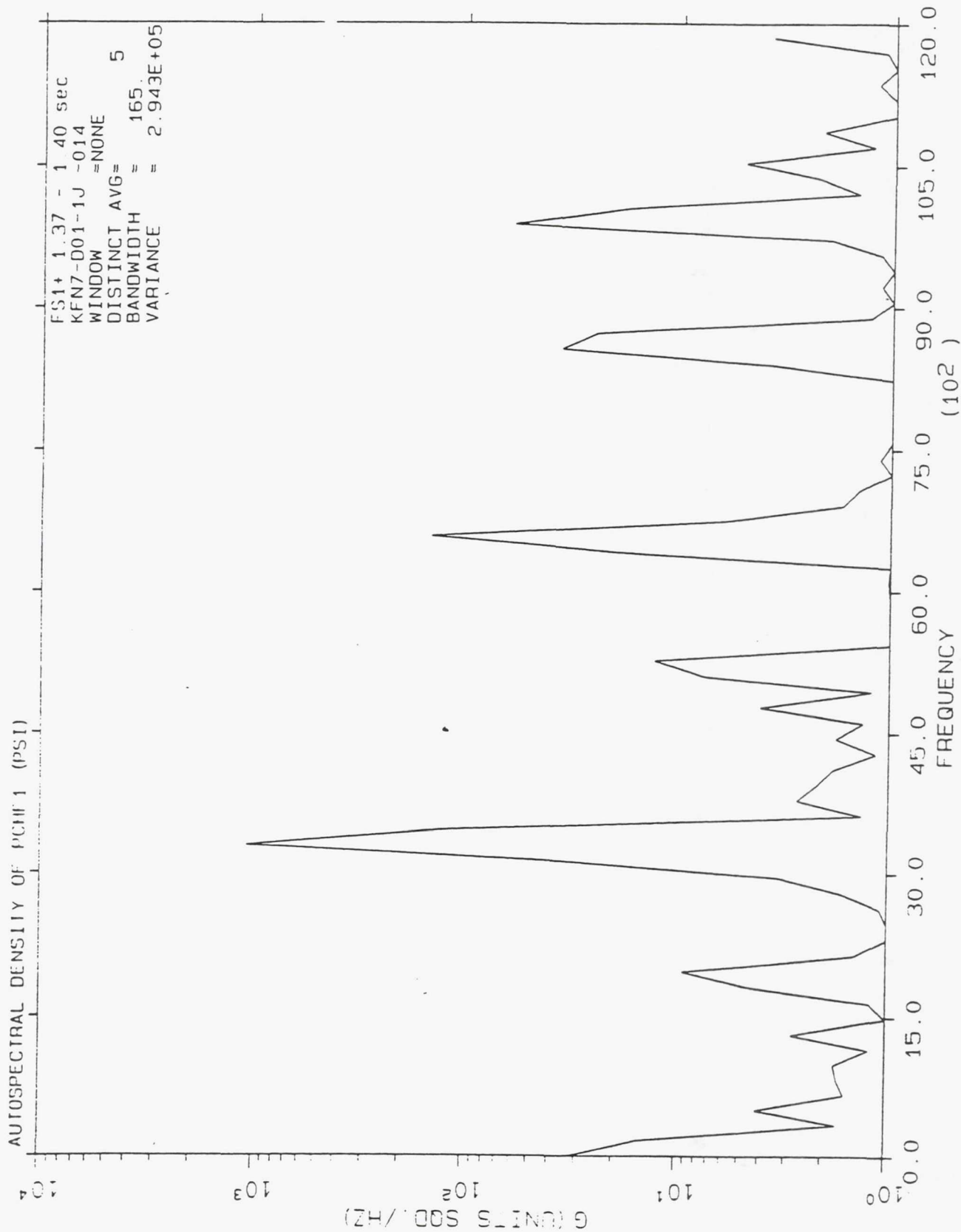
Time zero = FS1+1 31 SEC
KFN7-D01-1J -014



SPECTRA OF PCHF1 (PSI) : 20 SEGMENTS

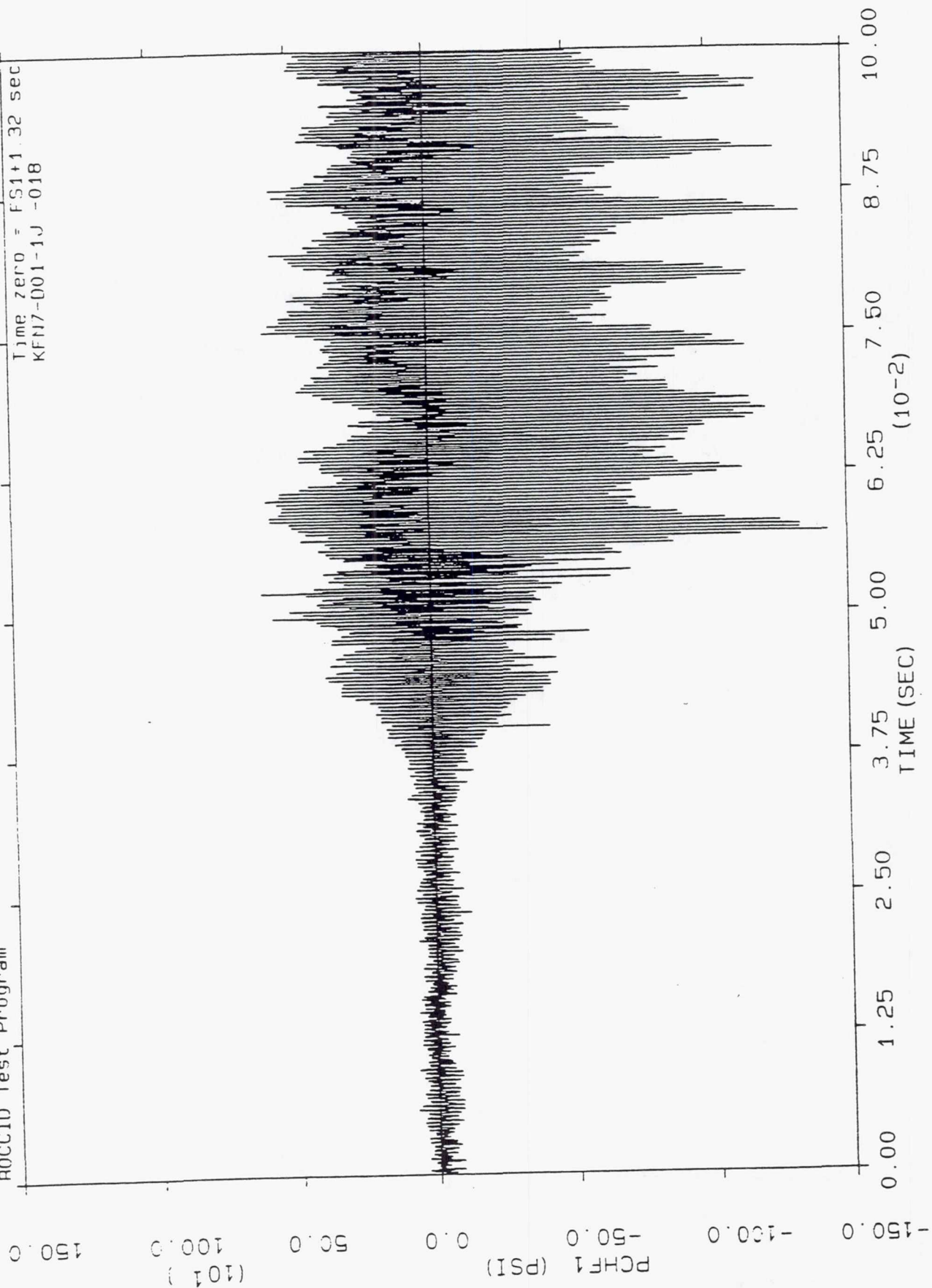
KFN7-D01-1J -014
 SEGMENT TIME = 5.000E-03
 DAMPLITUDE = 100.
 DF / SEGMENT = 200.
 DH / SEGMENT = 60 0



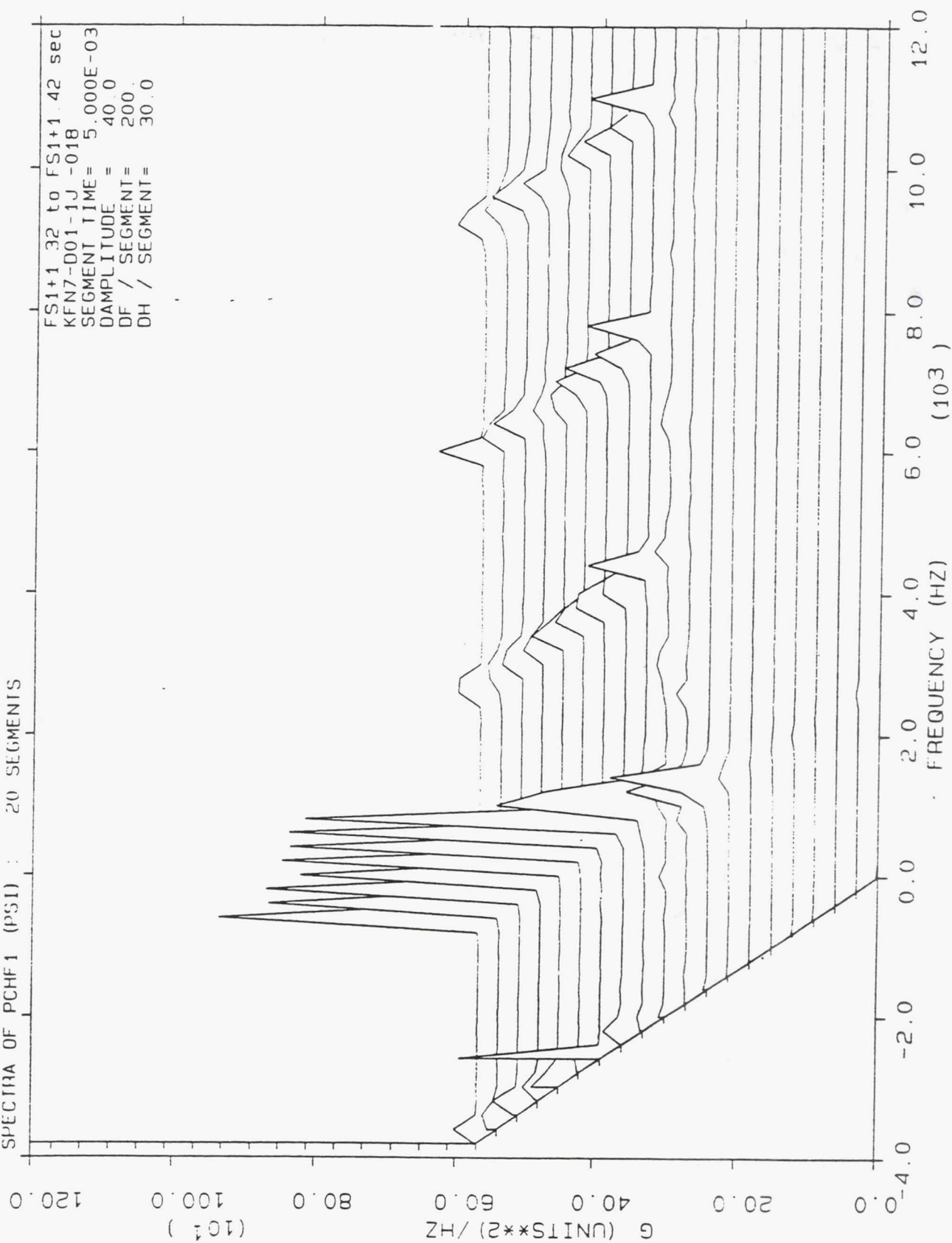


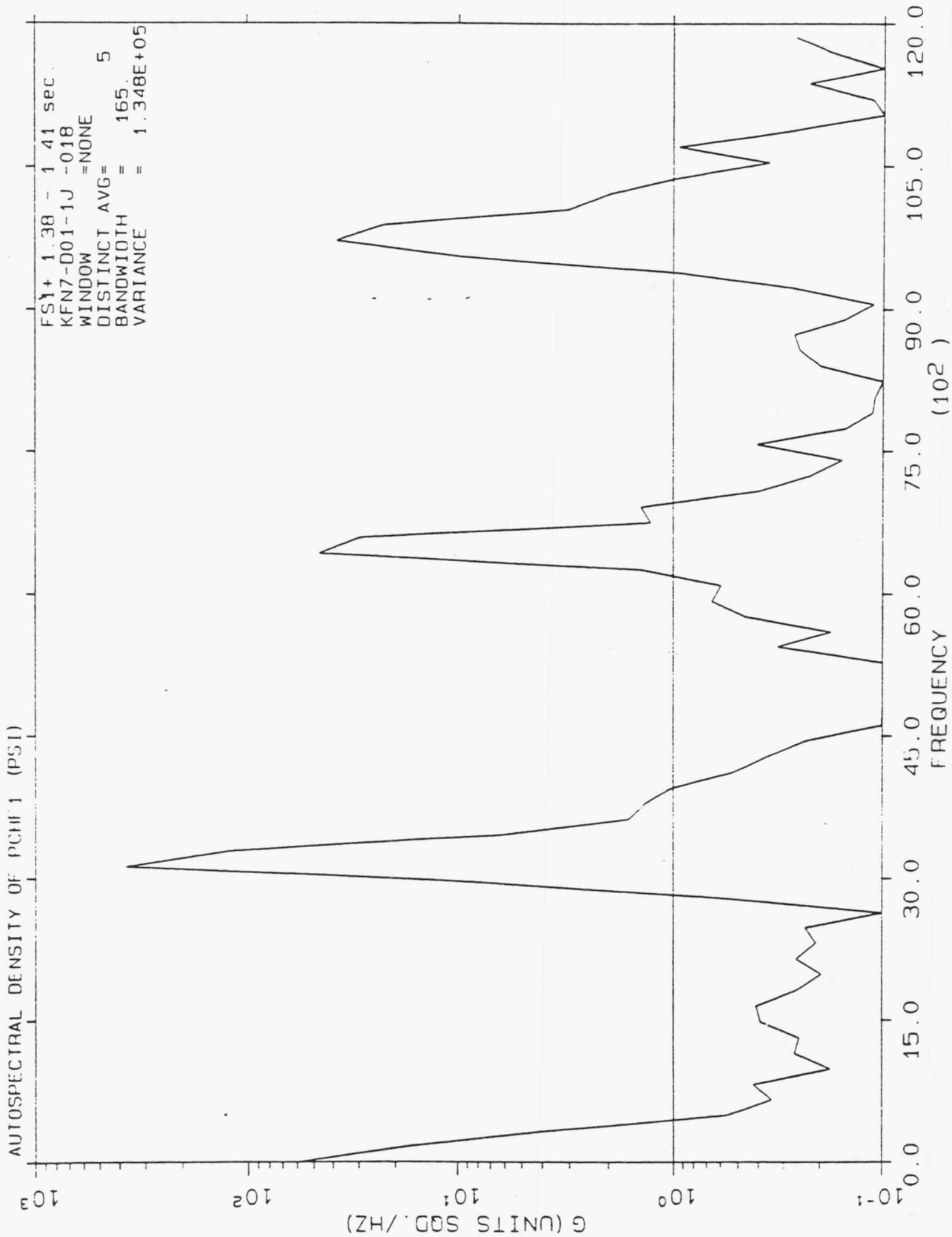
ROCCID Test Program

Time zero = FS1+1.32 sec
KFN7-D01-1J -018



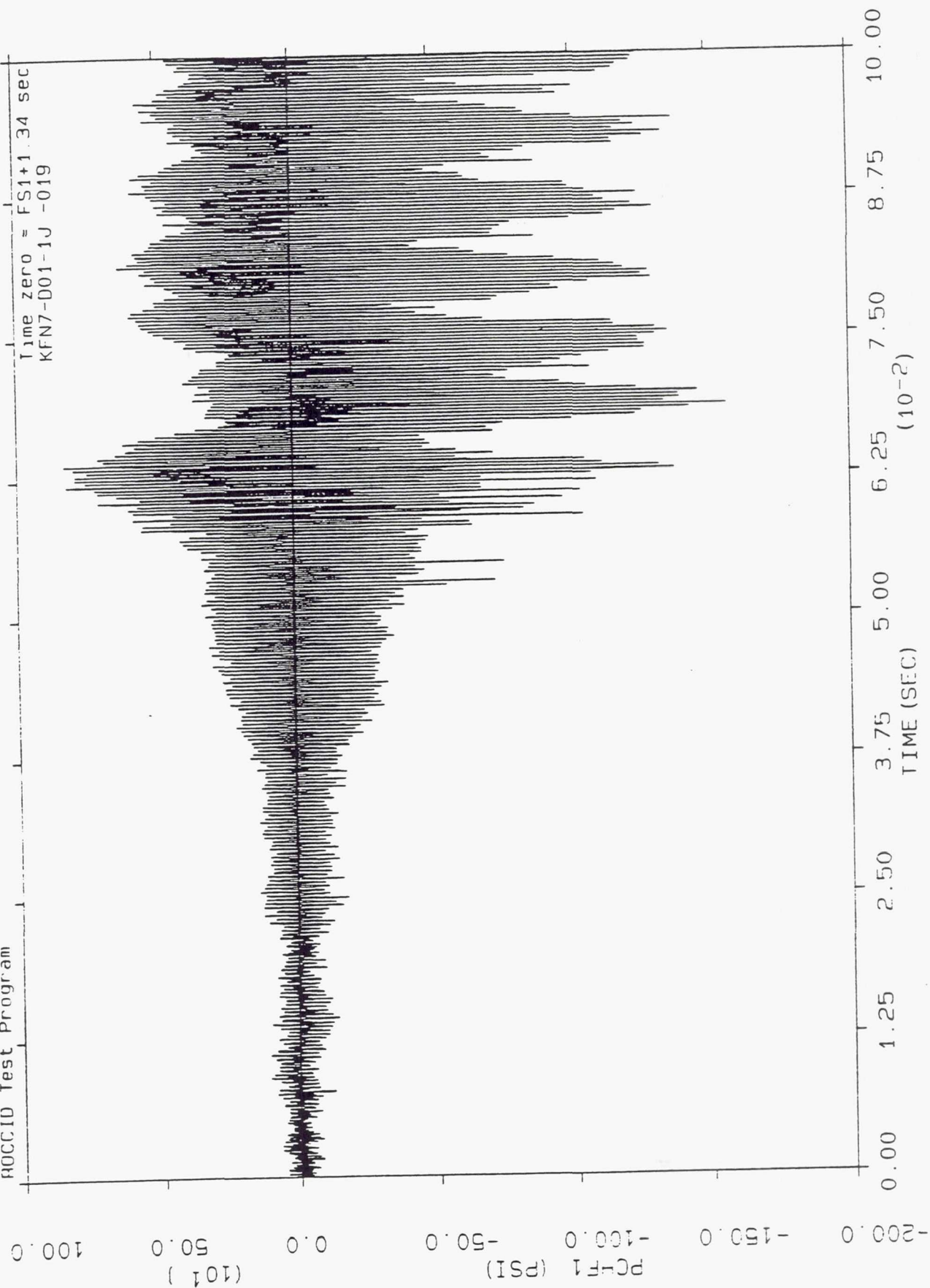
SPECTRA OF PCHF1 (PSI) : 20 SEGMENTS





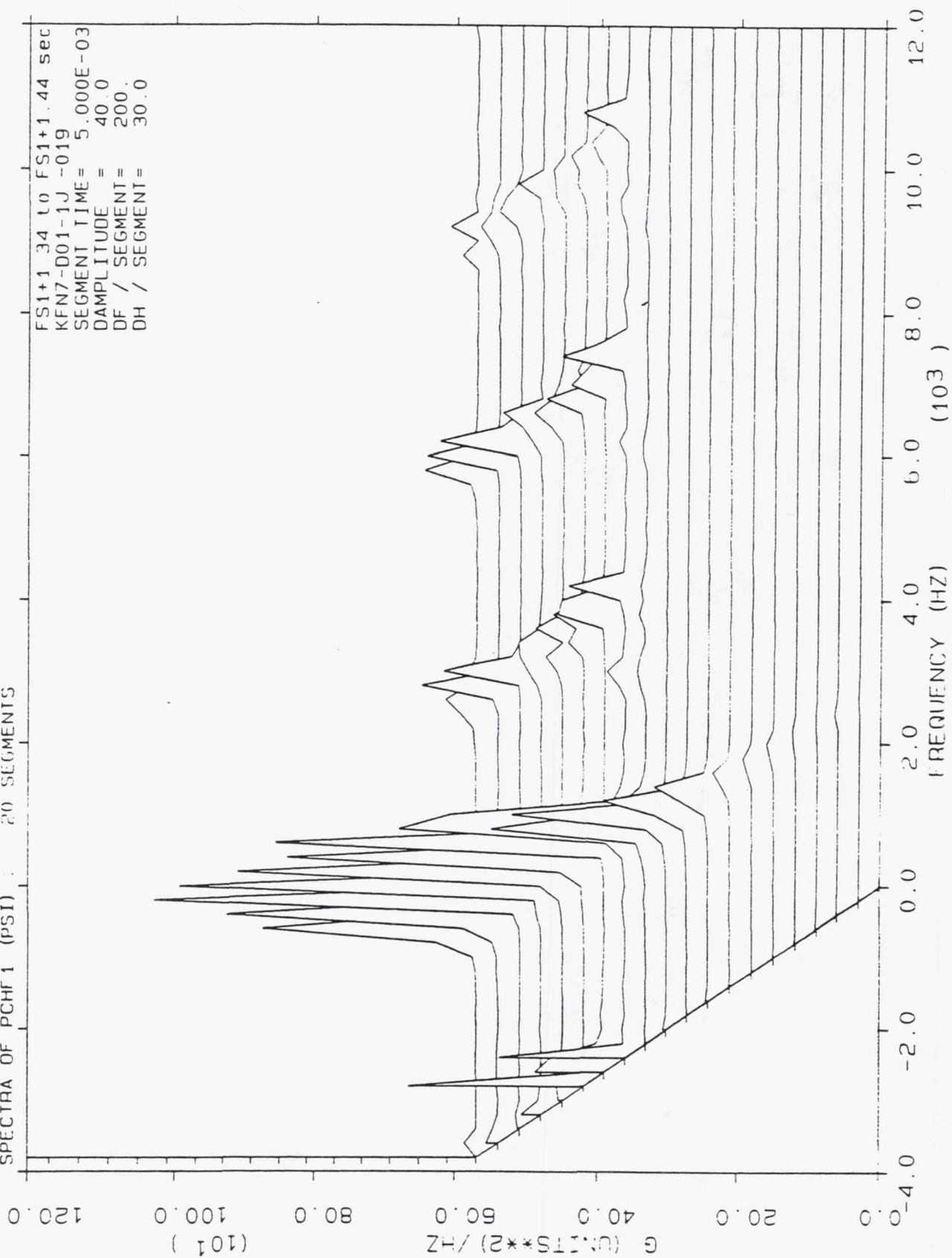
ROCCID Test Program

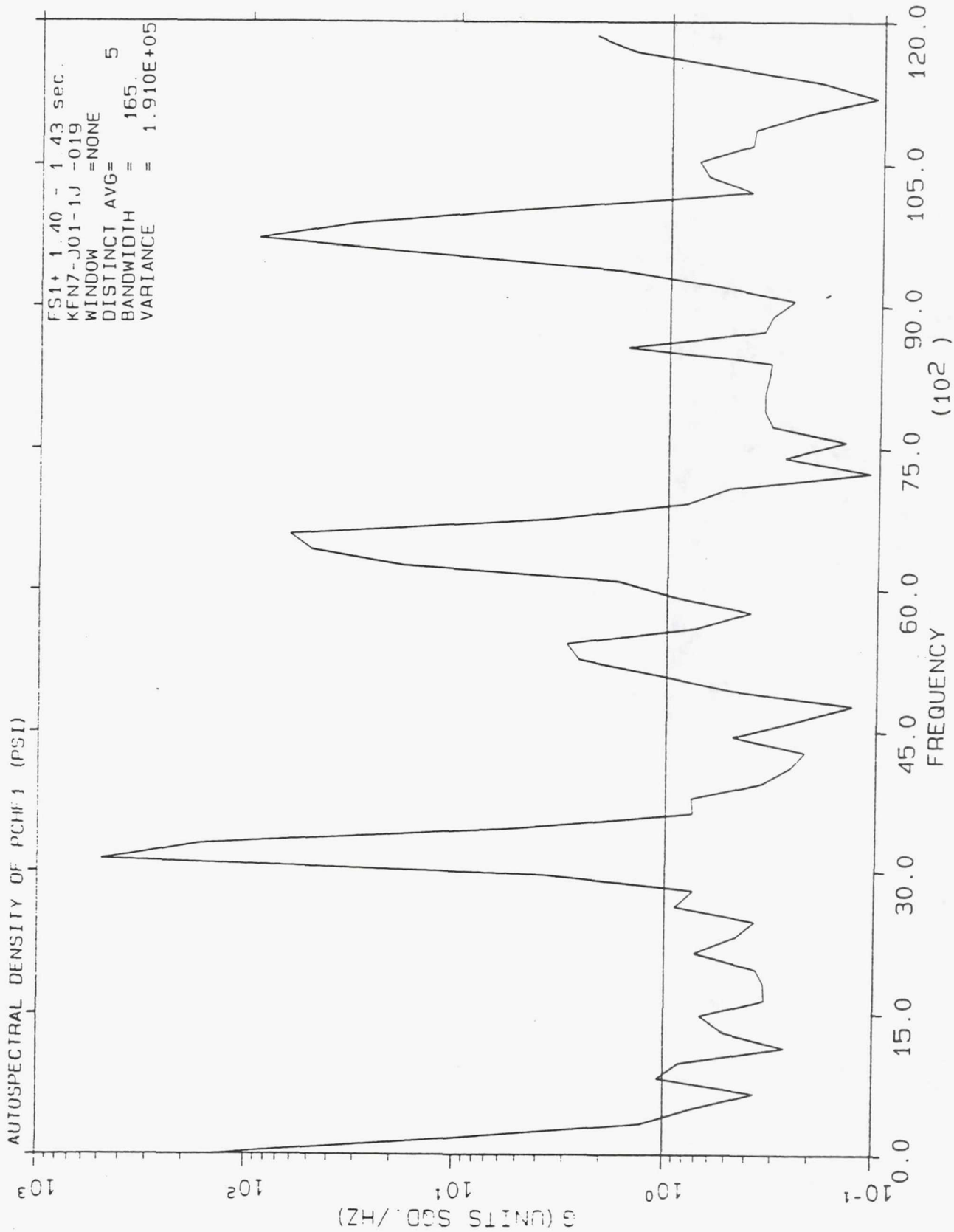
Time zero = FS1+1.34 sec
KFN7-D01-1J -019



SPECTRA OF PCHF 1 (PSI) : 20 SEGMENTS

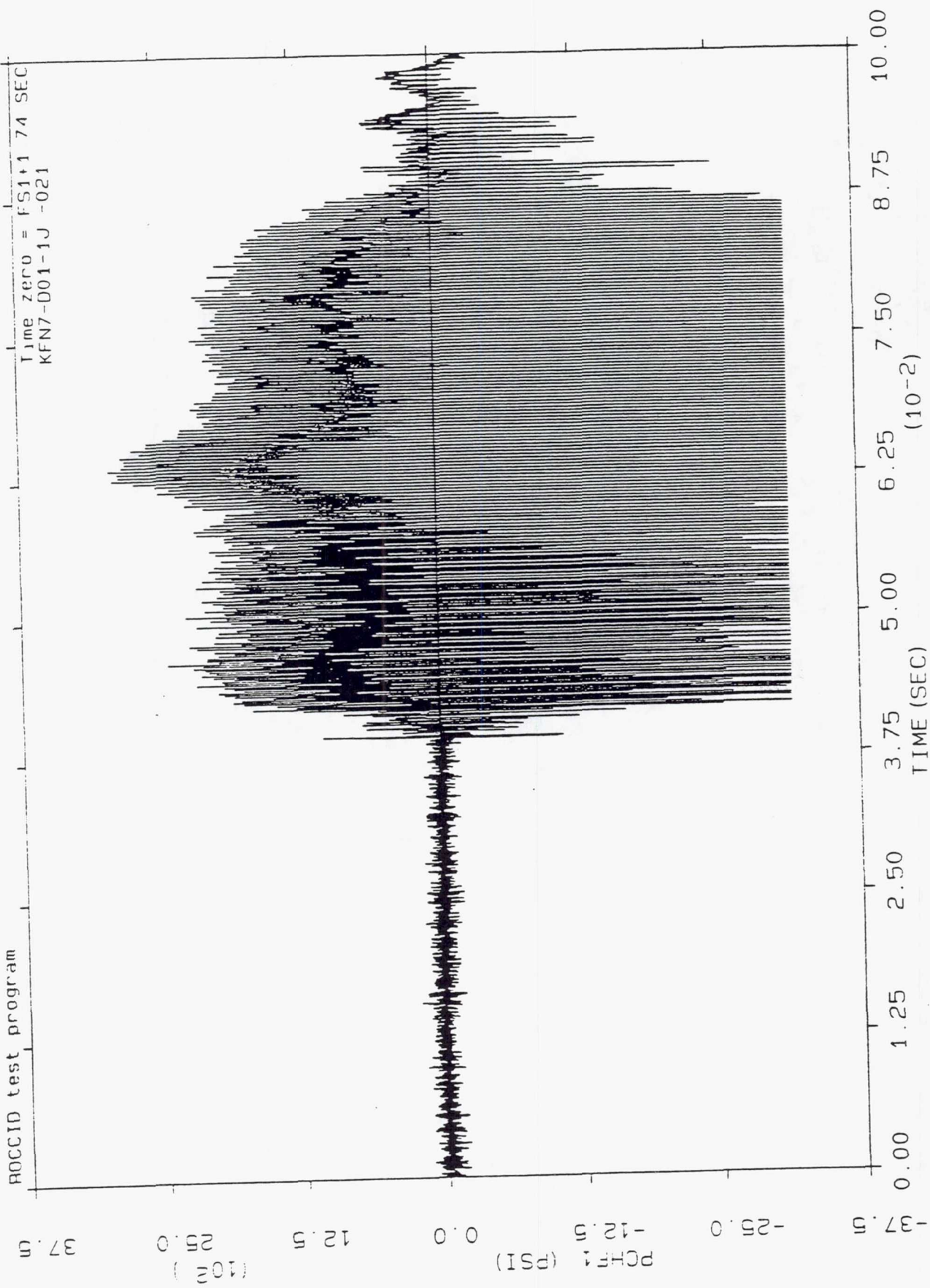
FS1+1 34 to FS1+1.44 sec
 KFN7-D01-1J -019
 SEGMENT TIME= 5.000E-03
 DAMPLITUDE = 40.0
 DF / SEGMENT= 200.
 DH / SEGMENT= 30.0





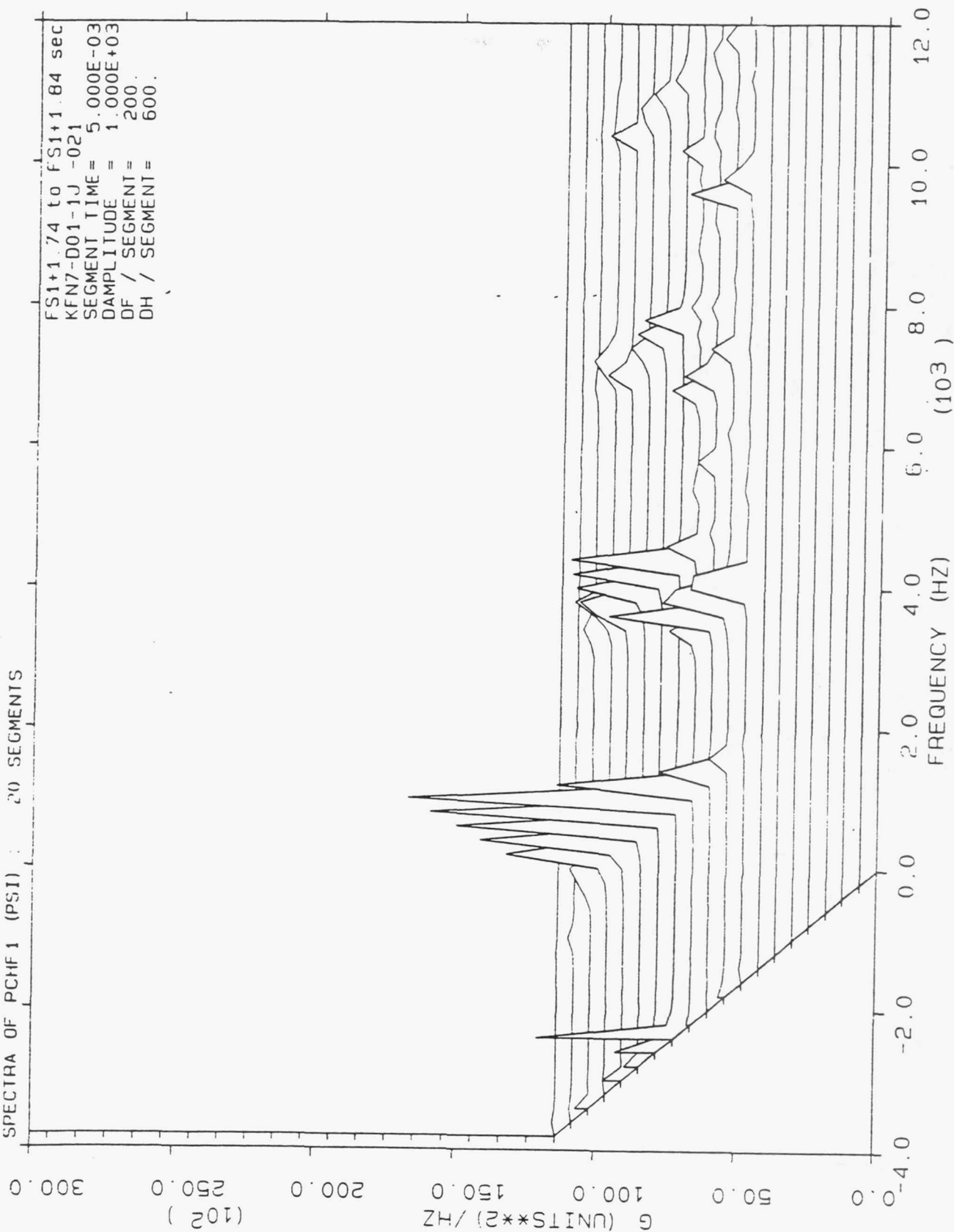
ROCCID test program

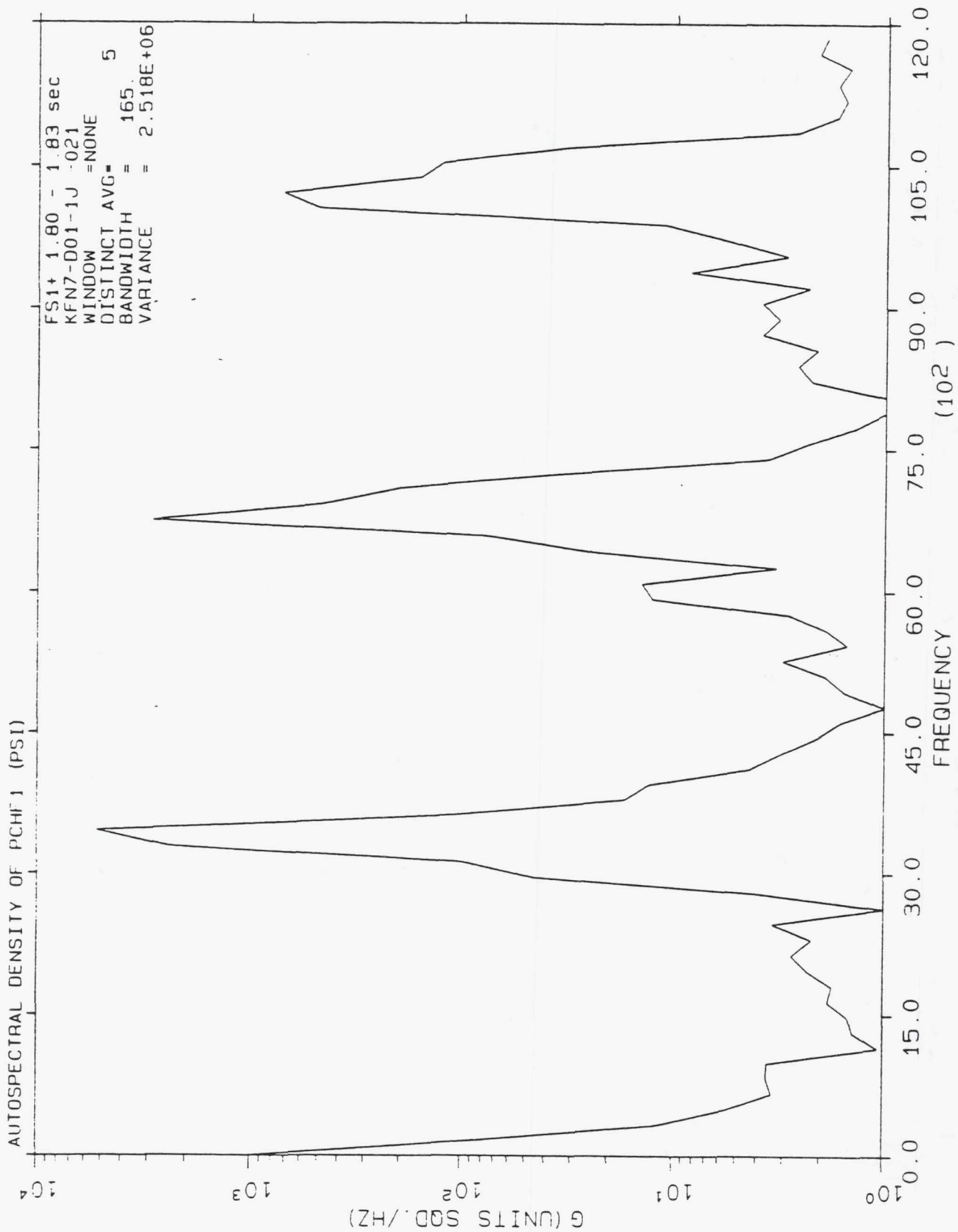
Time zero = FS1+1 74 SEC
KFN7-D01-1J -021



SPECTRA OF PCHF 1 (PSI) : 20 SEGMENTS

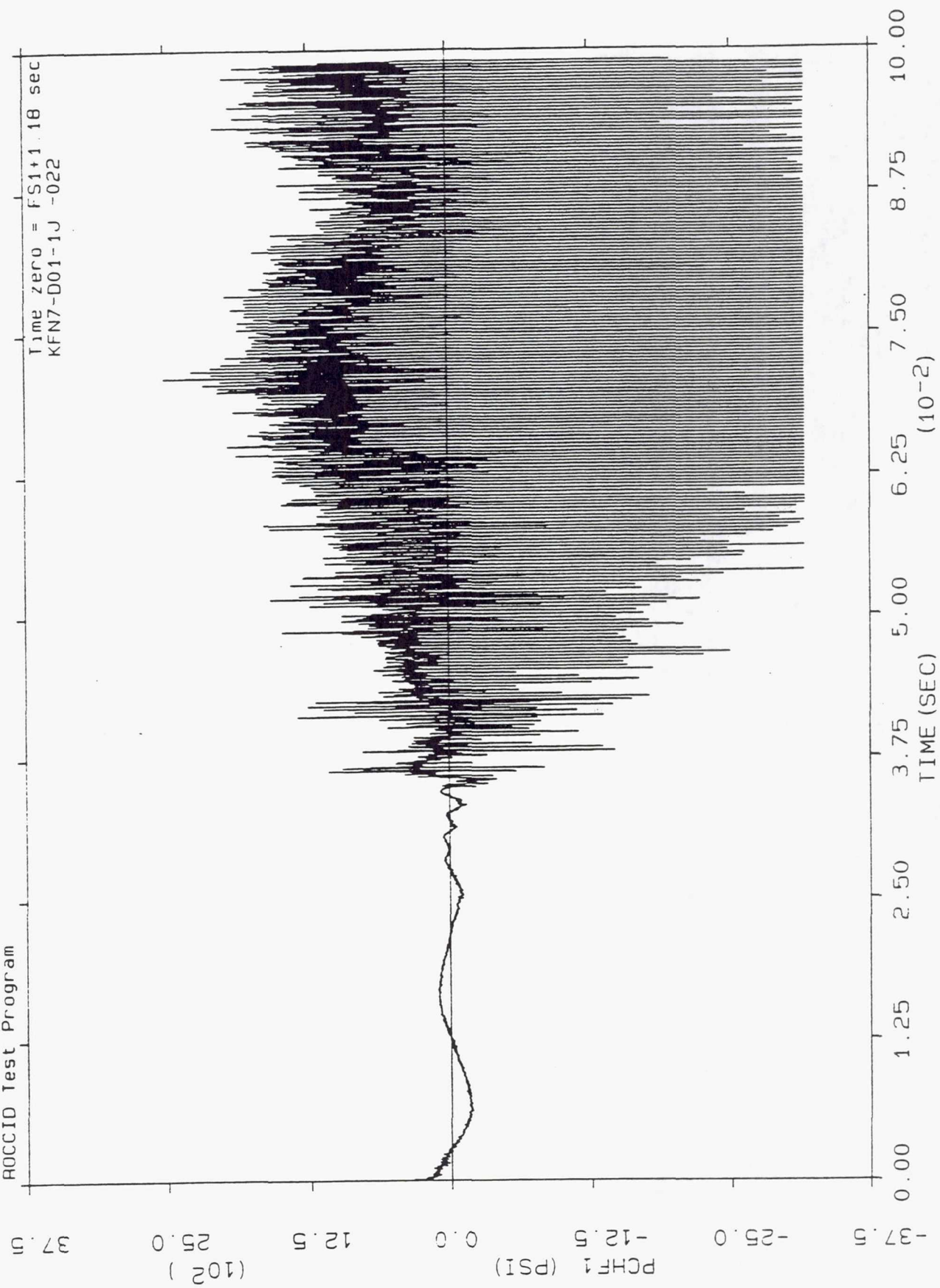
FS1+1.74 to FS1+1.84 sec
 KFN7-D01-1J -021
 SEGMENT TIME = 5.000E-03
 DAMPLITUDE = 1.000E+03
 DF / SEGMENT = 200.
 DH / SEGMENT = 600.





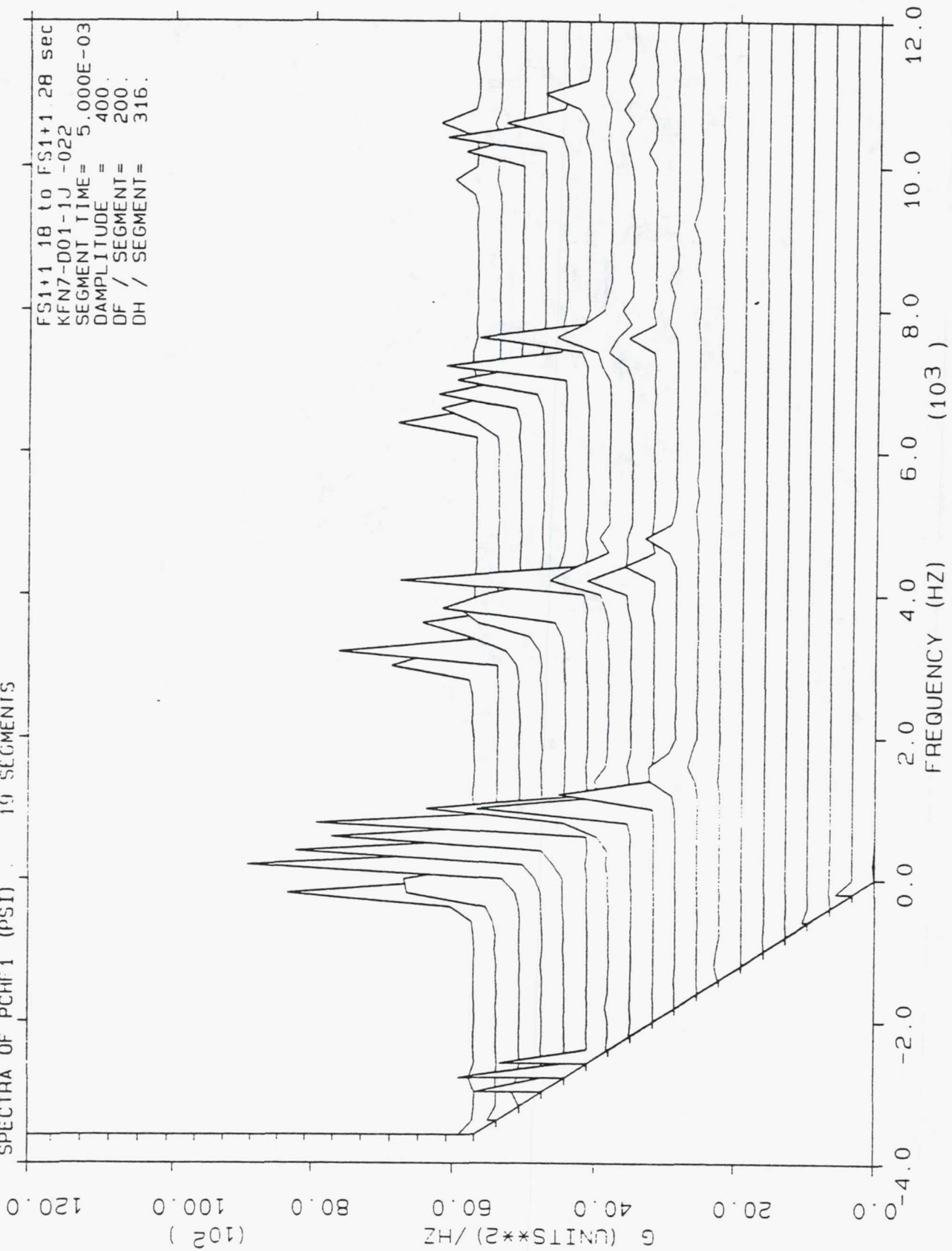
ROCCID Test Program

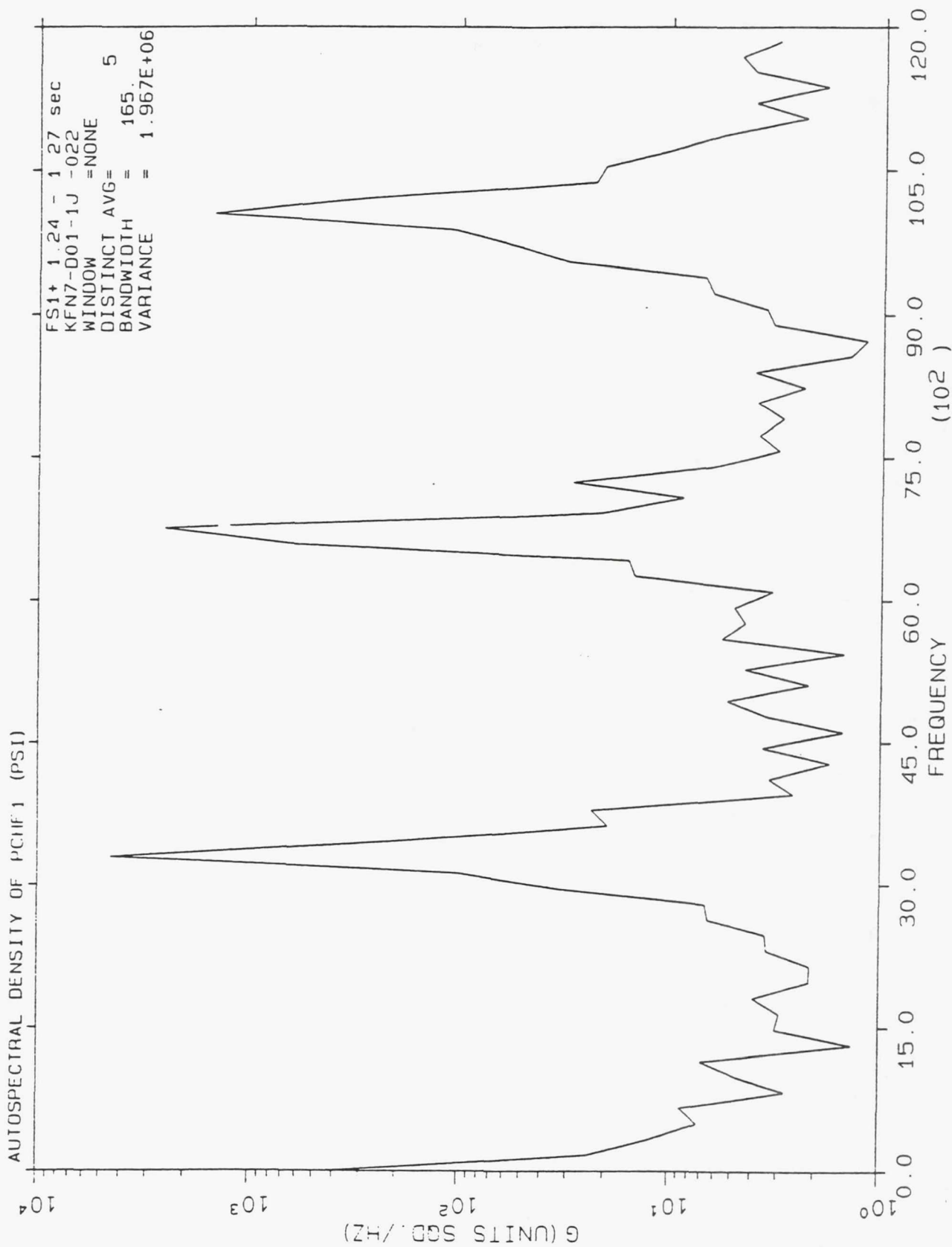
Time zero = FS1+1.18 sec
KFN7-D01-1J -022

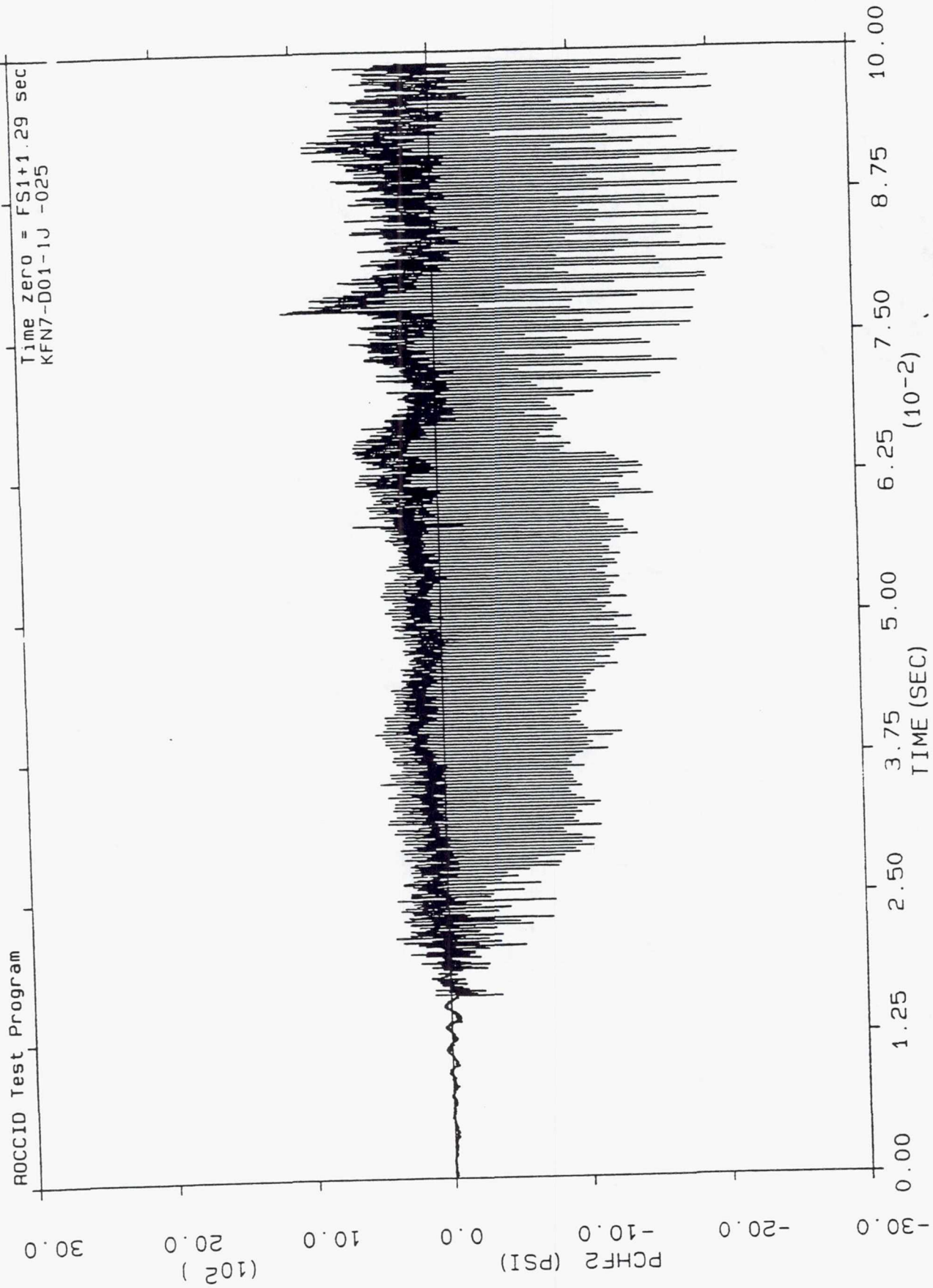


SPECTRA OF PCH1 (PSI) 19 SEGMENTS

FS1+1 18 to FS1+1 28 sec
 KFN7-D01-1J -022
 SEGMENT TIME= 5.000E-03
 DAMPLITUDE = 400.
 DF / SEGMENT= 200.
 DH / SEGMENT= 316.

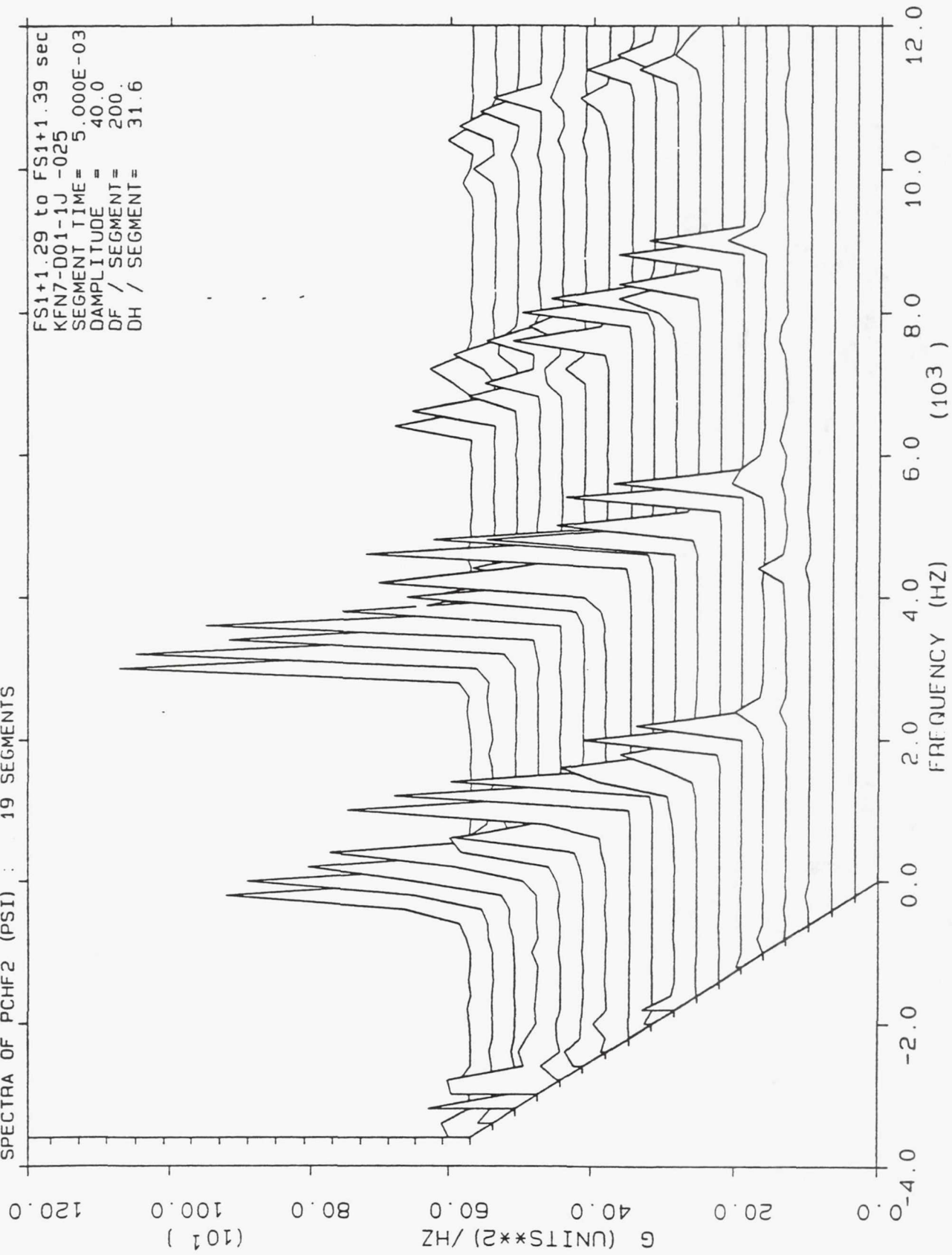


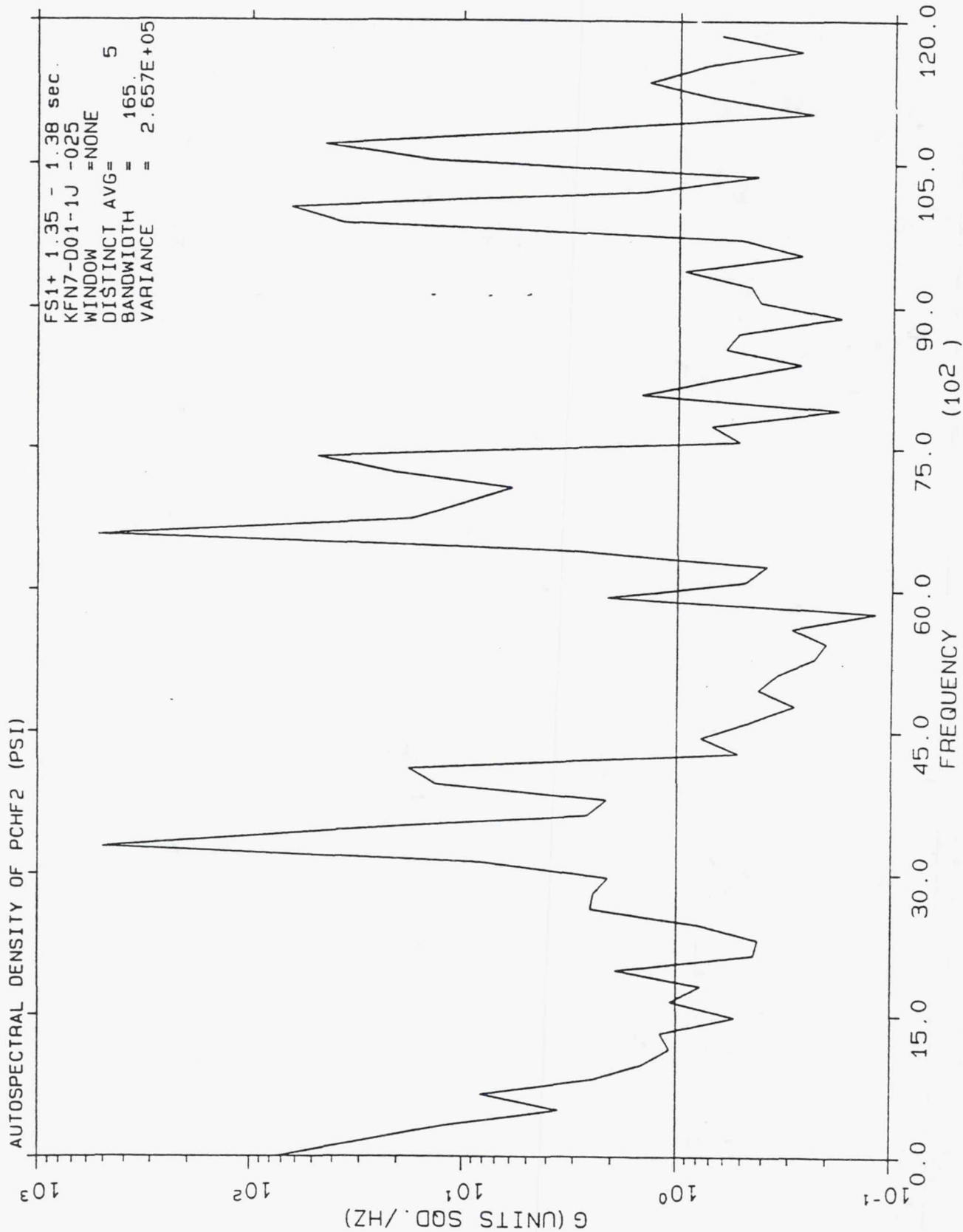


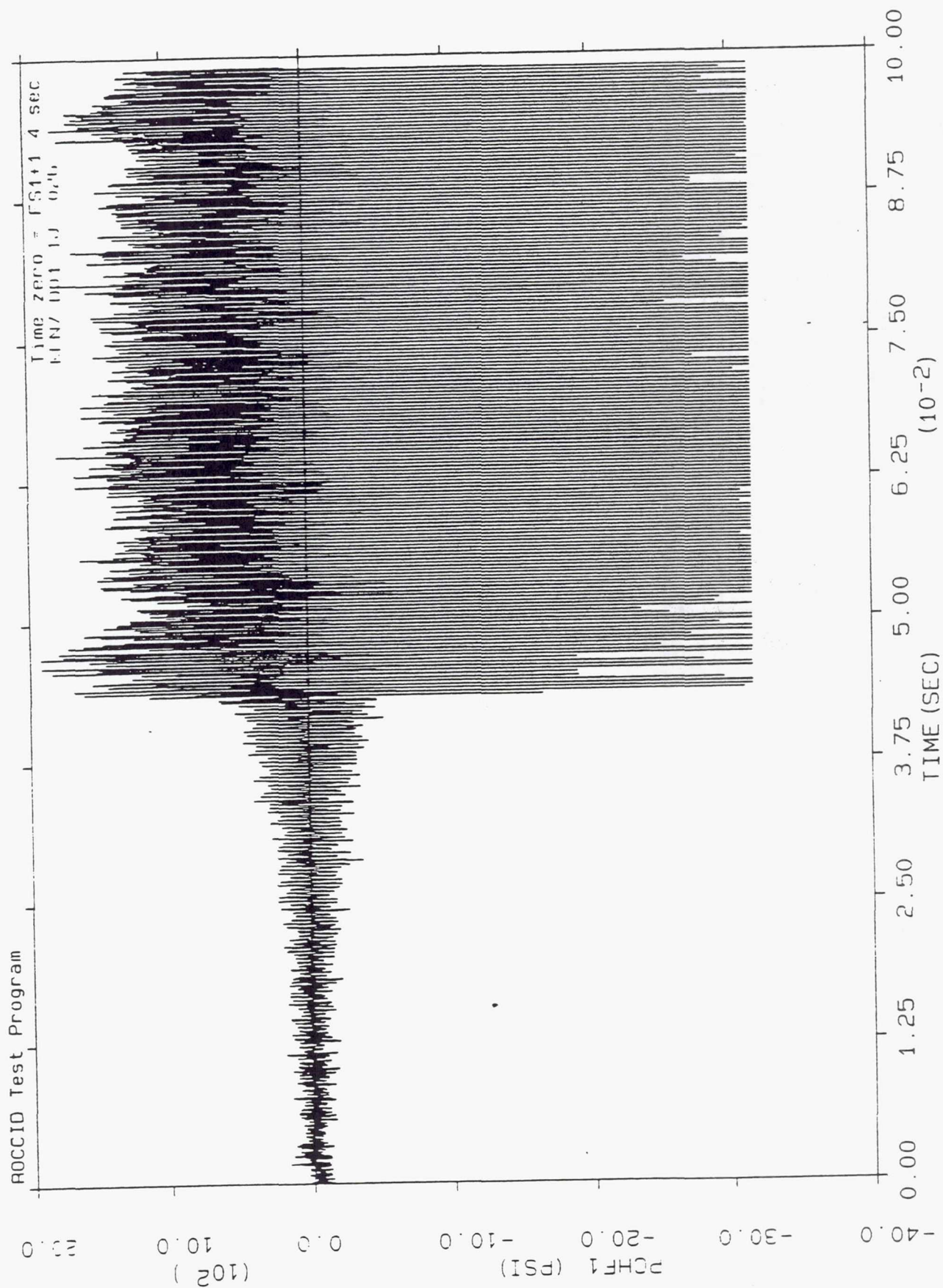


SPECTRA OF PCHF2 (PSI) : 19 SEGMENTS

FS1+1.29 to FS1+1.39 sec
 KFN7-D01-1J -025
 SEGMENT TIME= 5.000E-03
 DAMPLITUDE = 40.0
 DF / SEGMENT= 200.
 DH / SEGMENT= 31.6

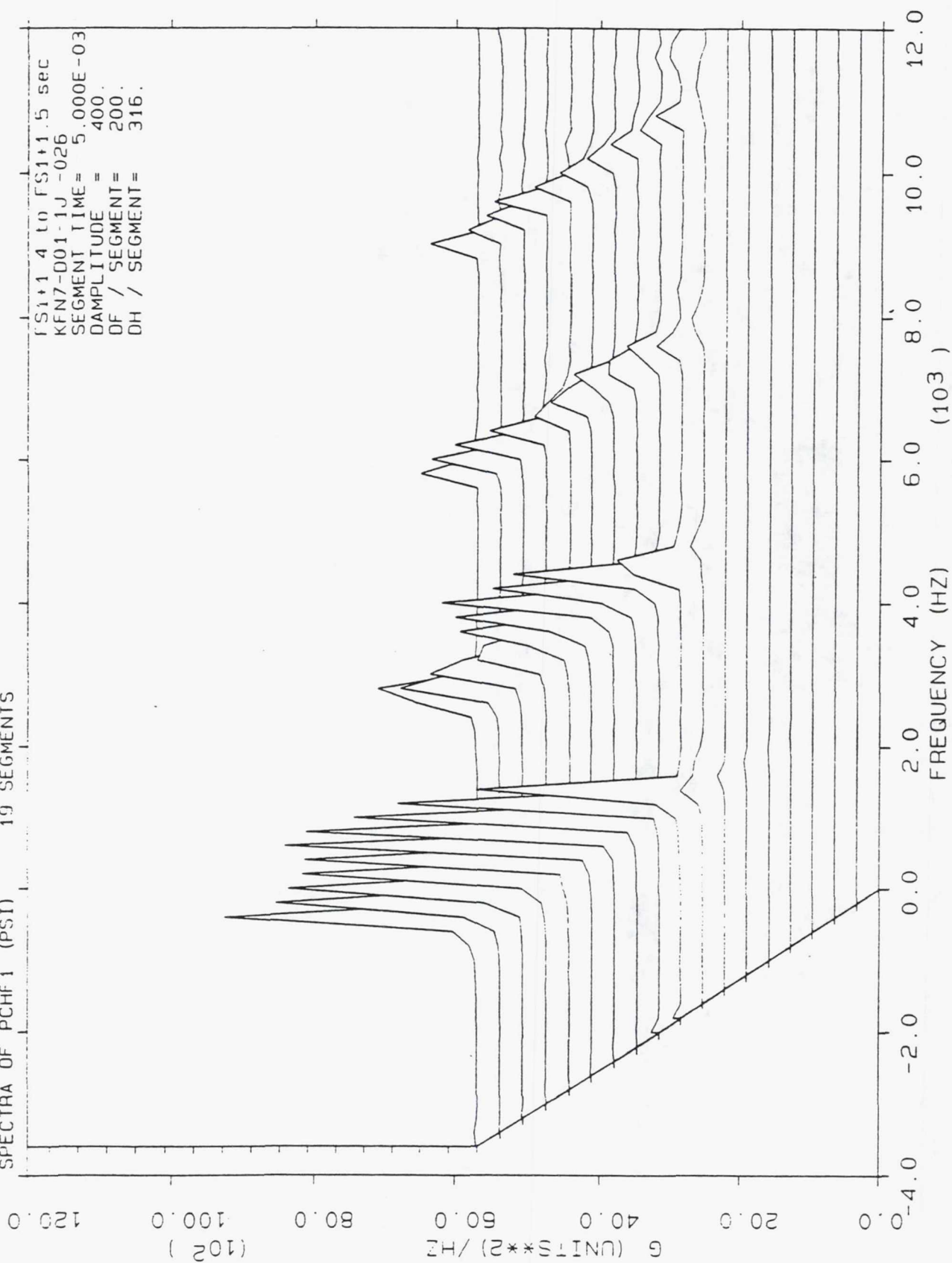


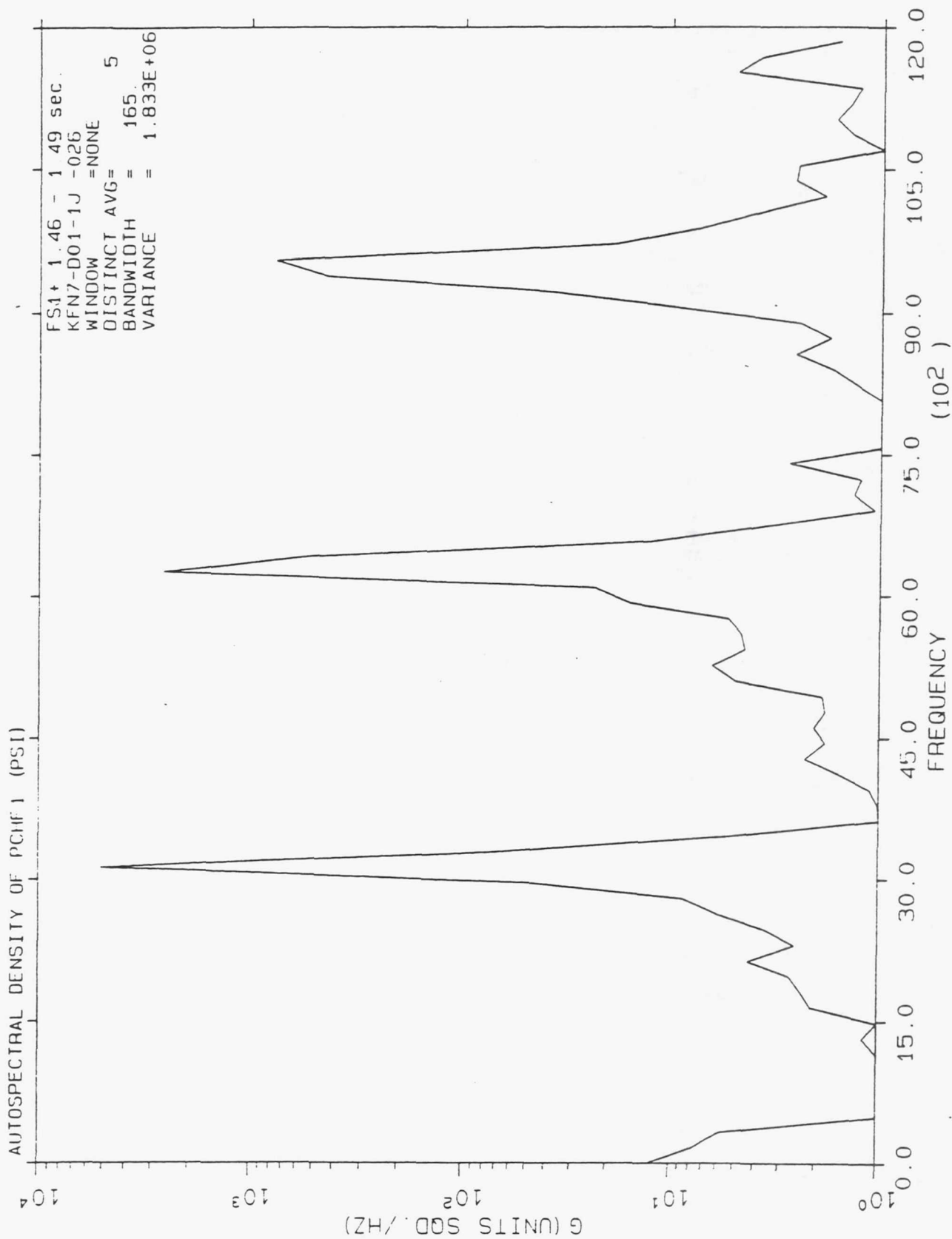




SPECTRA OF PCHF 1 (PSI) 19 SEGMENTS

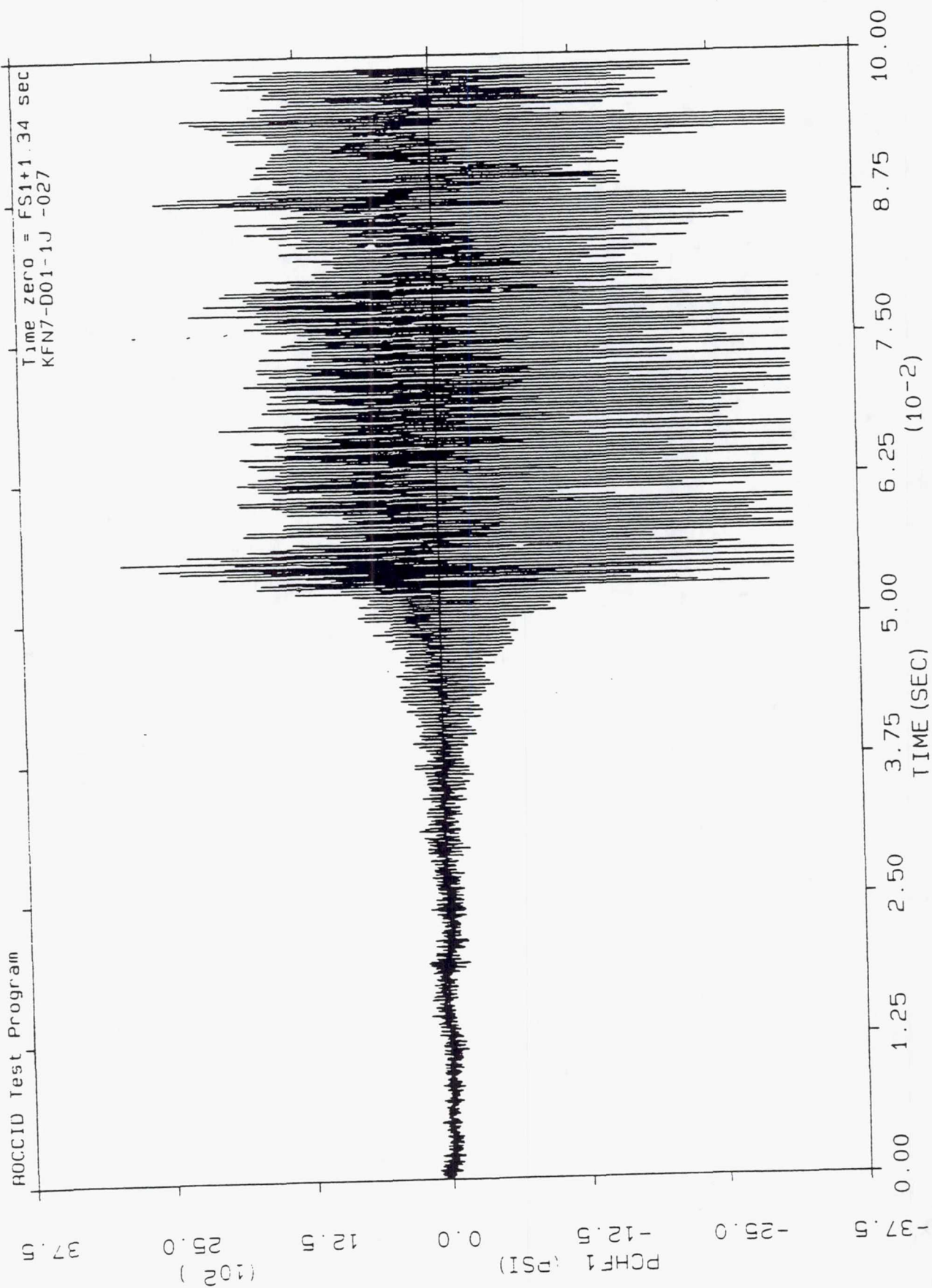
FS1+1 4 to FS1+1.5 sec
 KFN7-001-1J -026
 SEGMENT TIME= 5.000E-03
 DAMPLITUDE = 400.
 OF / SEGMENT= 200.
 DH / SEGMENT= 316.



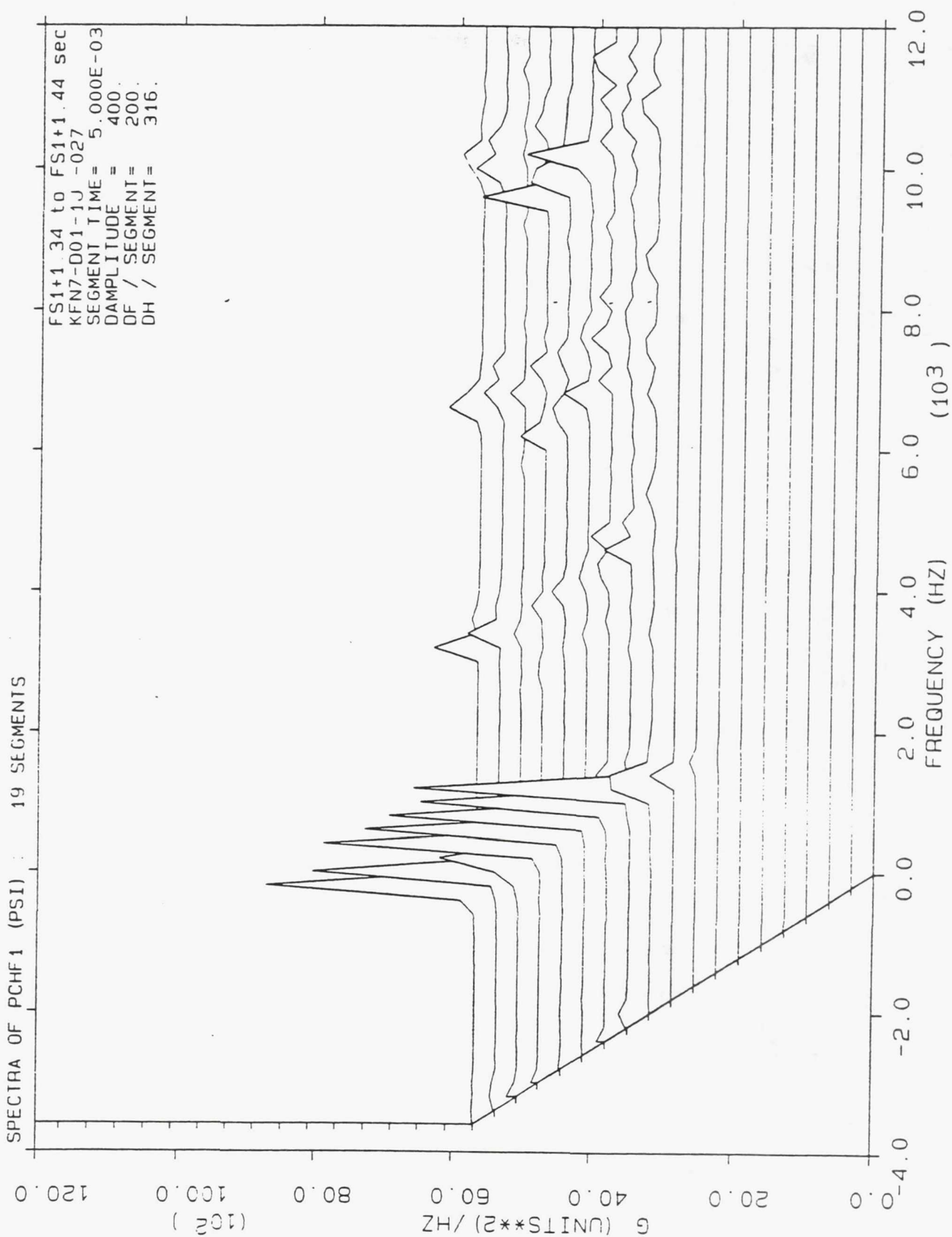


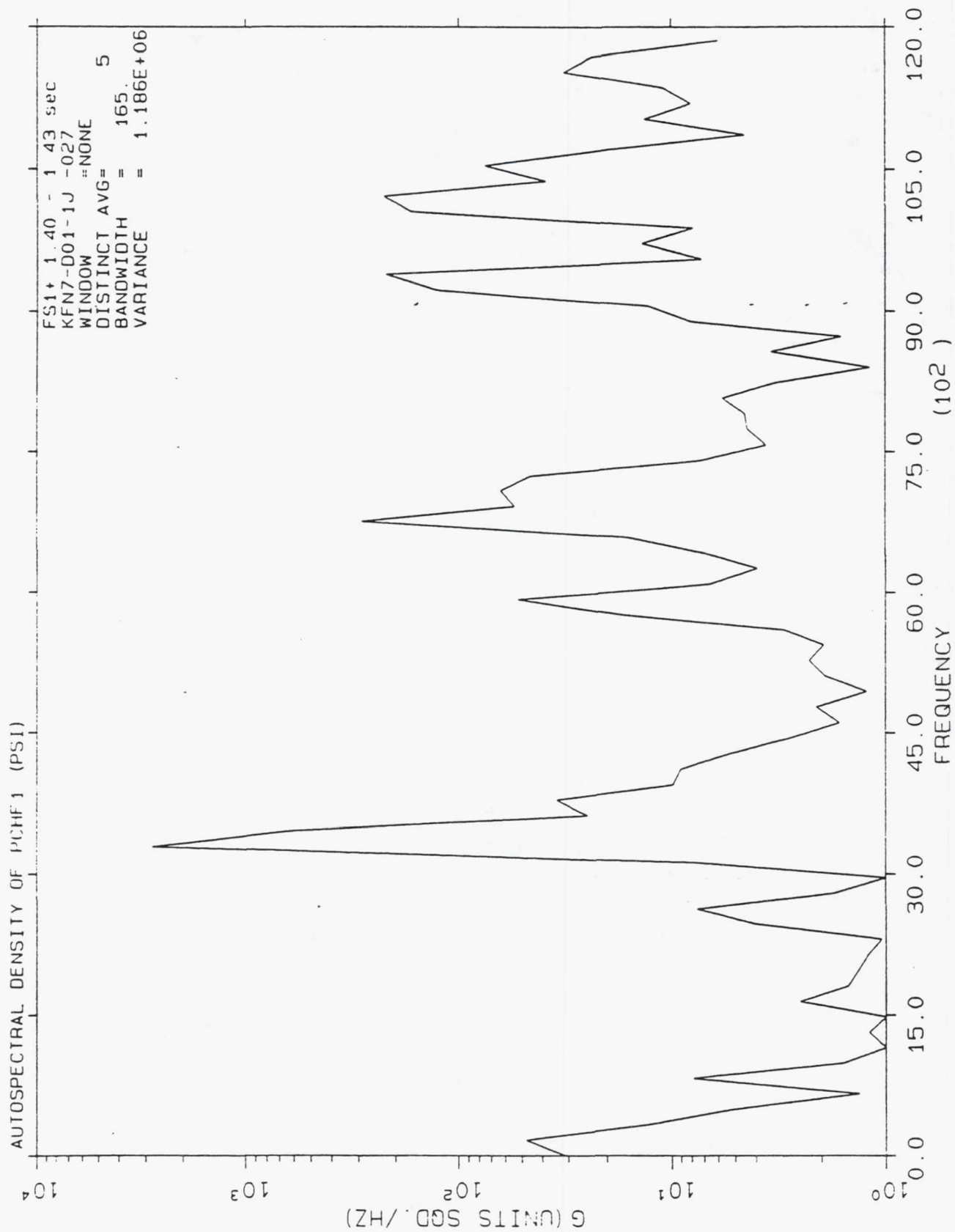
ROCCID Test Program

Time zero = FS1+1.34 sec
KFN7-D01-1J -027



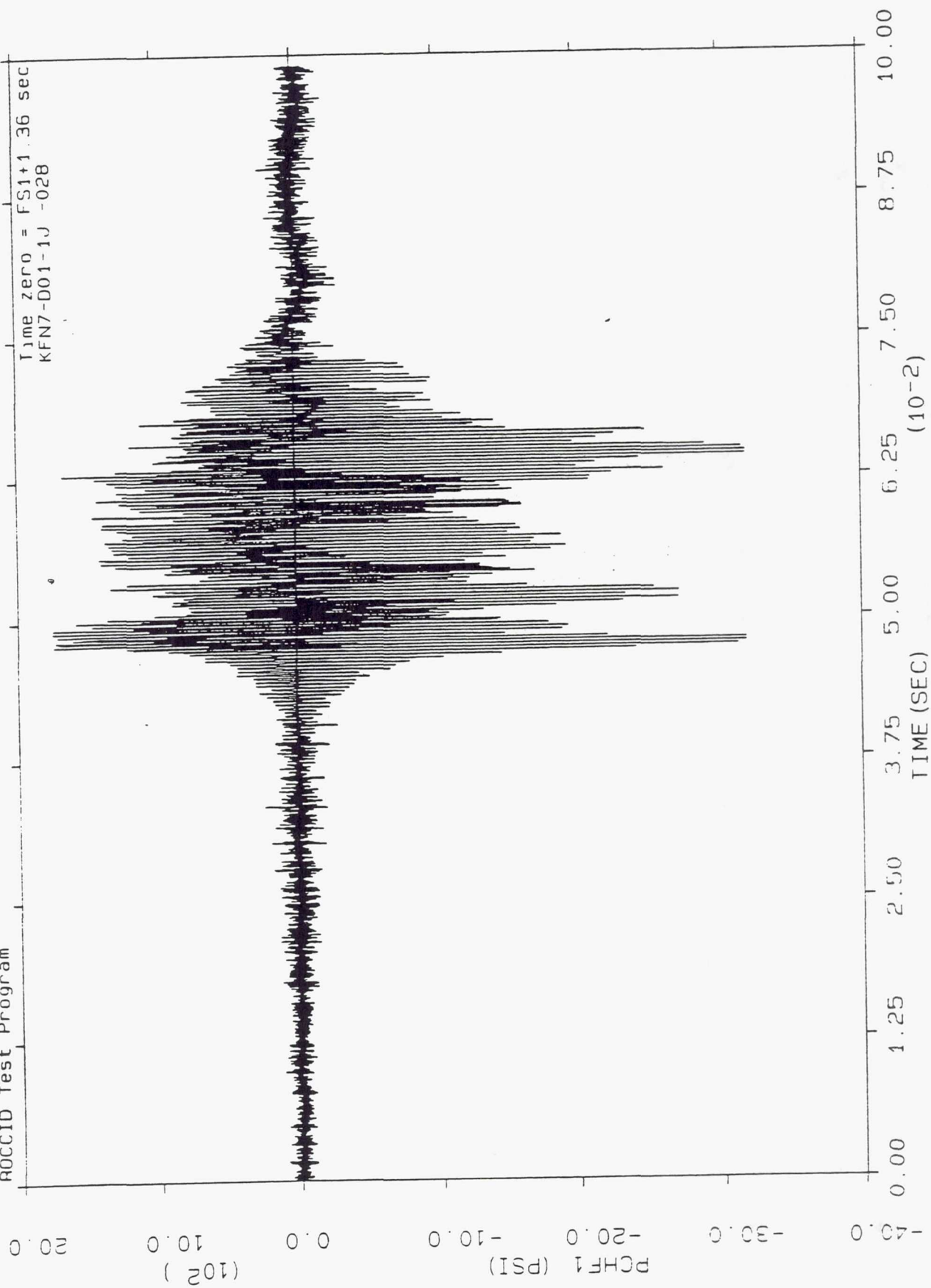
SPECTRA OF PCHF1 (PSI) : 19 SEGMENTS





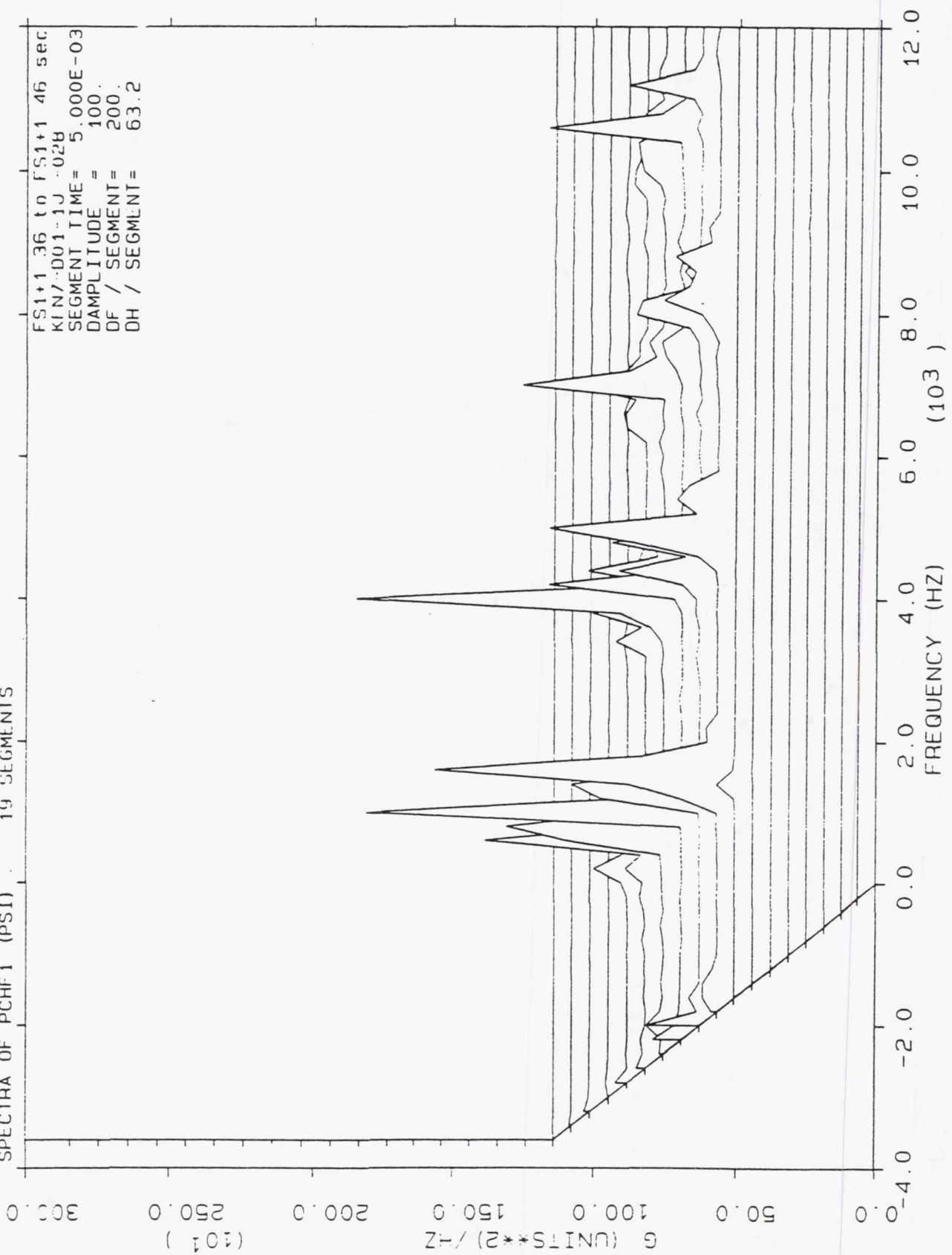
ROCCID Test Program

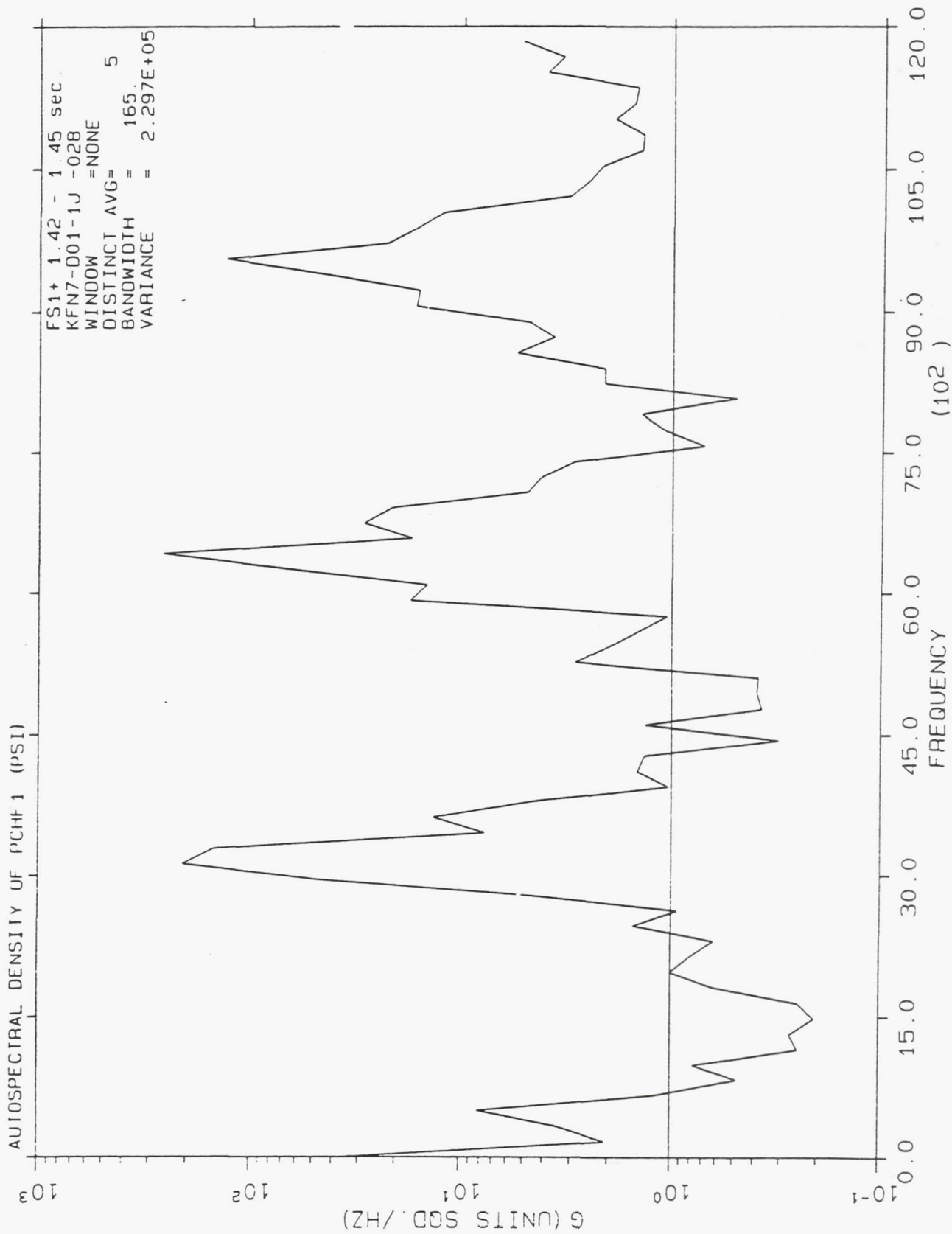
Time zero = FS1+1.36 sec
KFN7-D01-1J -028



SPECTRA OF PCHF1 (PSI) 19 SEGMENTS

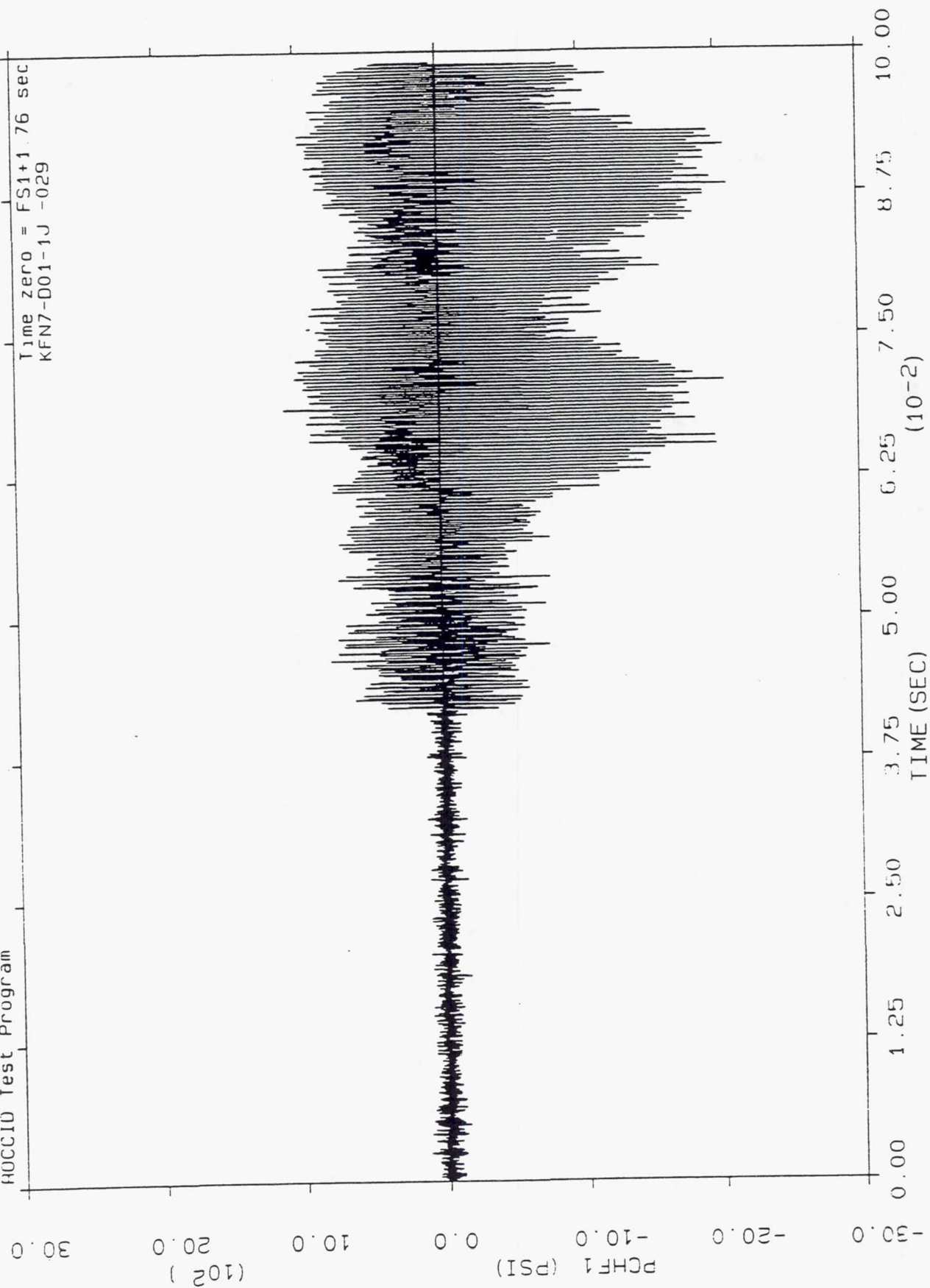
FS1+1 36 to FS1+1 46 sec
 KIN/D01-1J -02B
 SEGMENT TIME= 5.000E-03
 DAMPLITUDE = 100.
 OF / SEGMENT= 200.
 DH / SEGMENT= 63.2





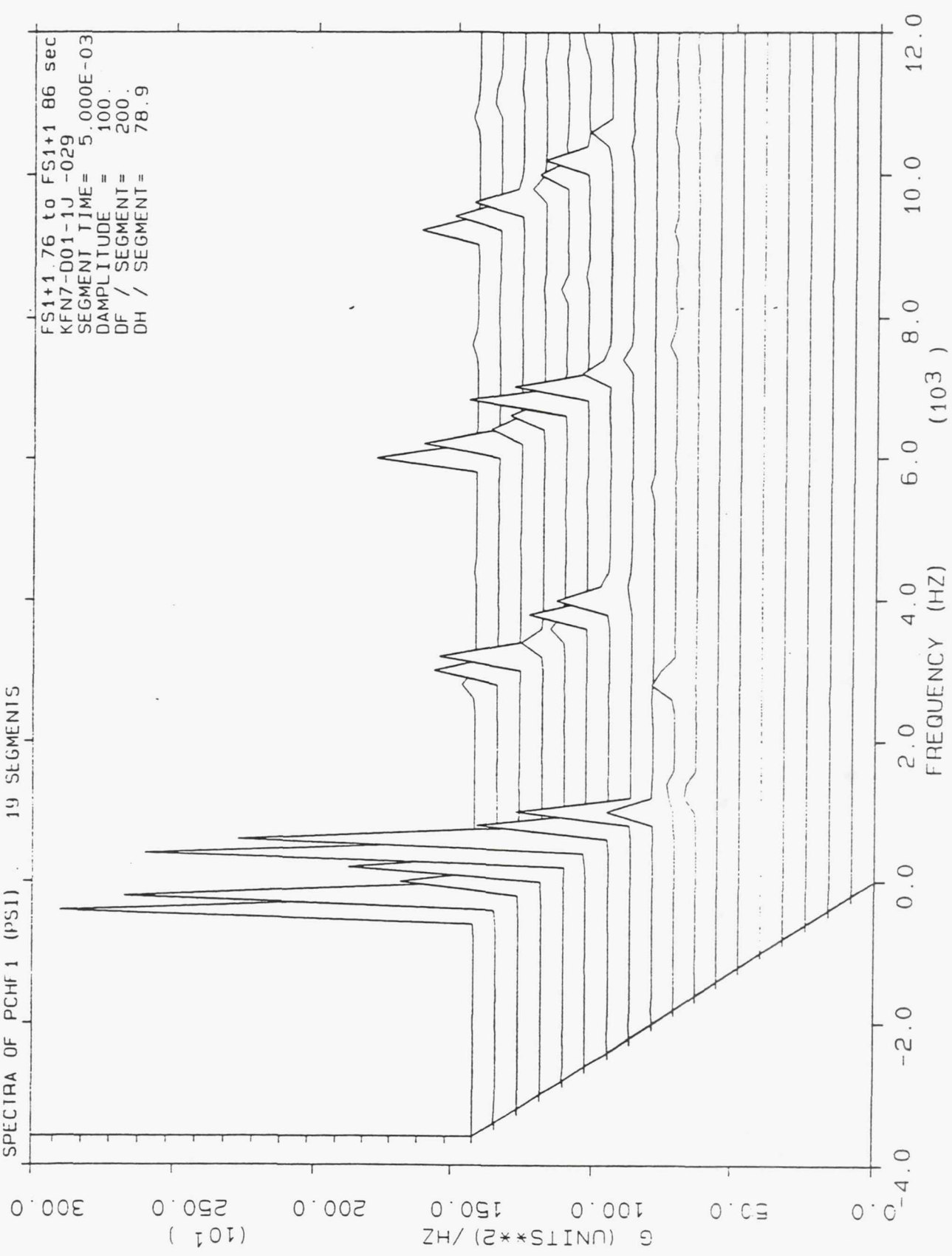
HOCC10 Test Program

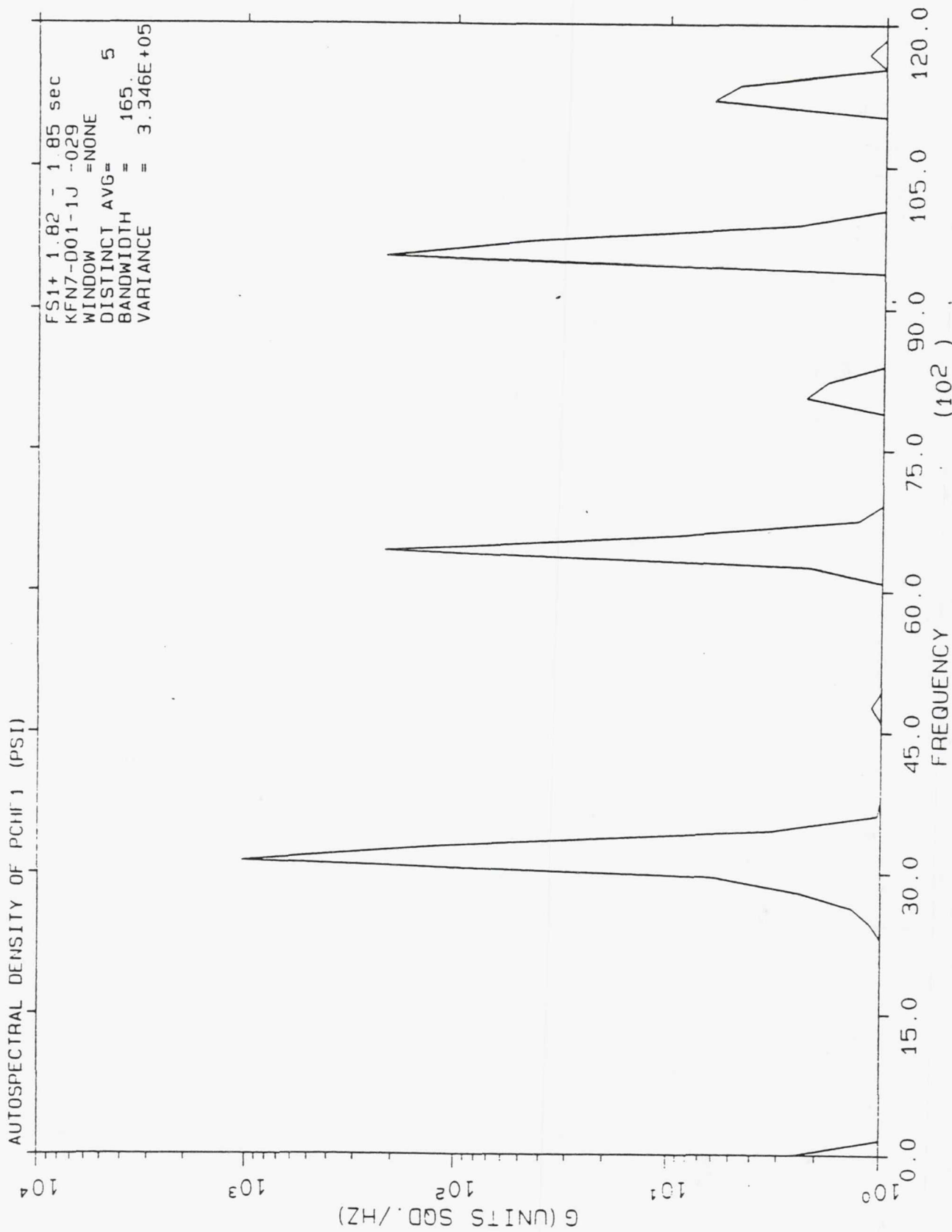
Time zero = FS1+1.76 sec
KFN7-D01-1J -029

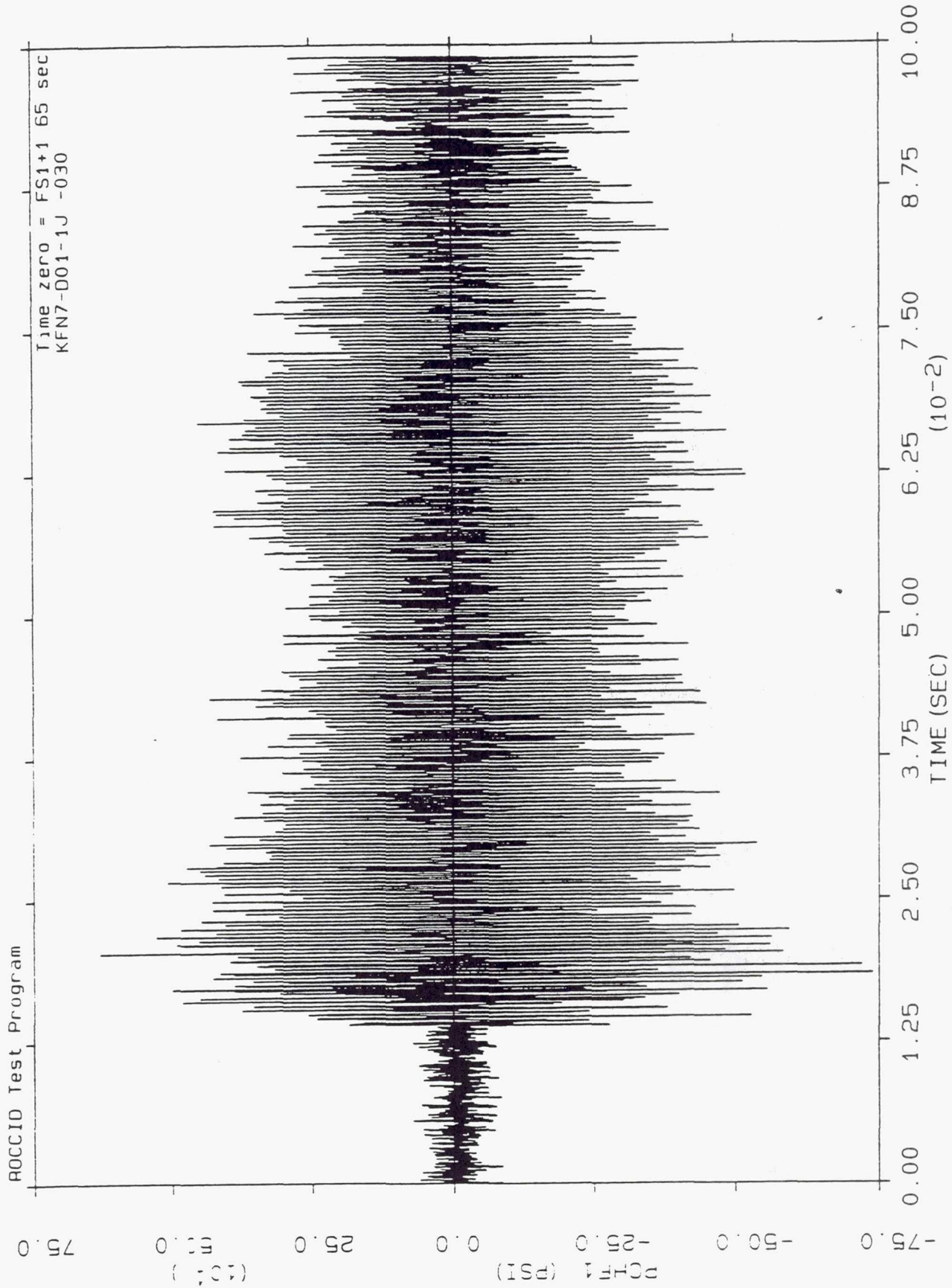


SPECTRA OF PCHF 1 (PSI) 19 SEGMENTS

FS1+1.76 to FS1+1.86 sec
KFN7-001-1J -029
SEGMENT TIME= 5.000E-03
DAMPLITUDE = 100.
DF / SEGMENT= 200.
DH / SEGMENT= 78.9

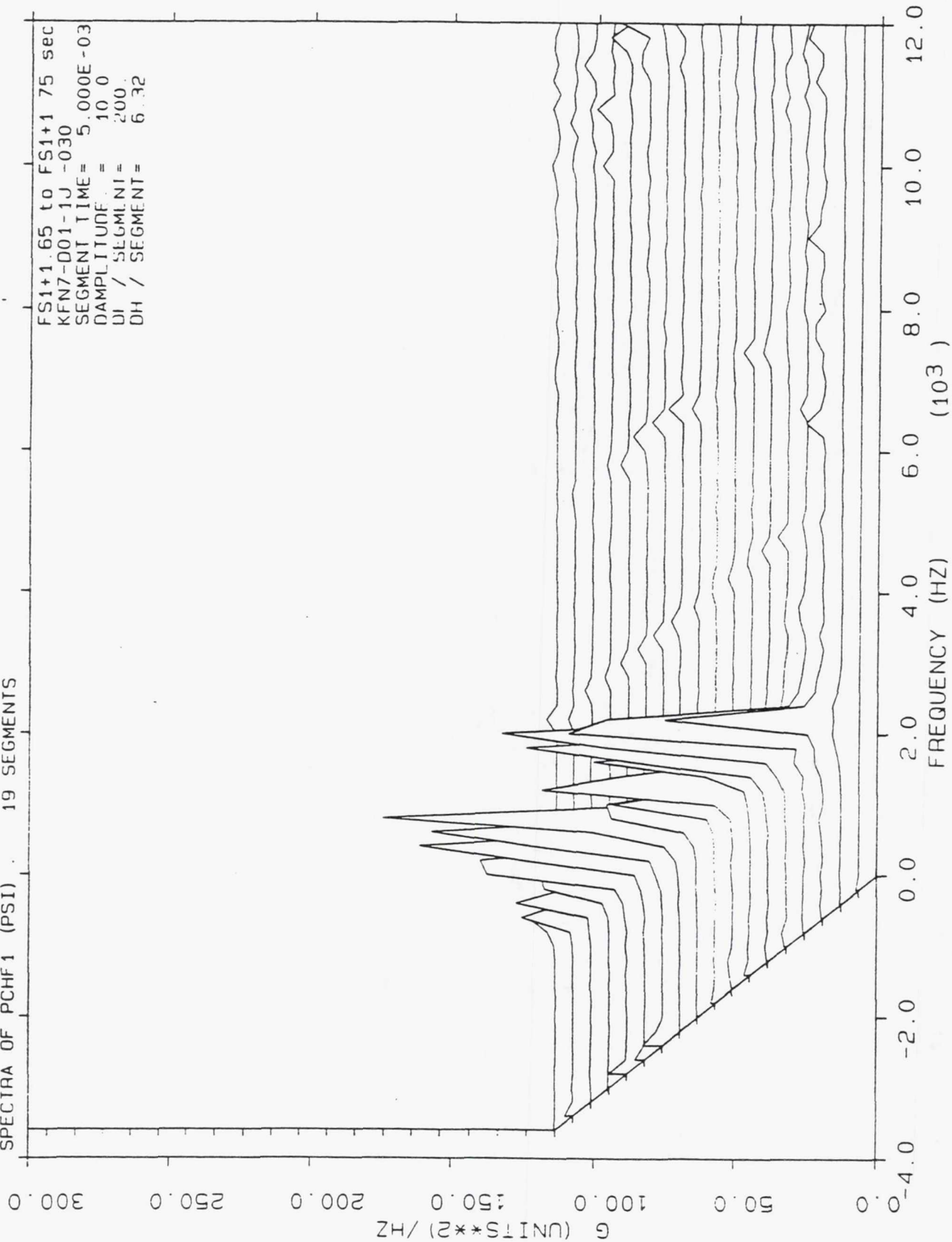


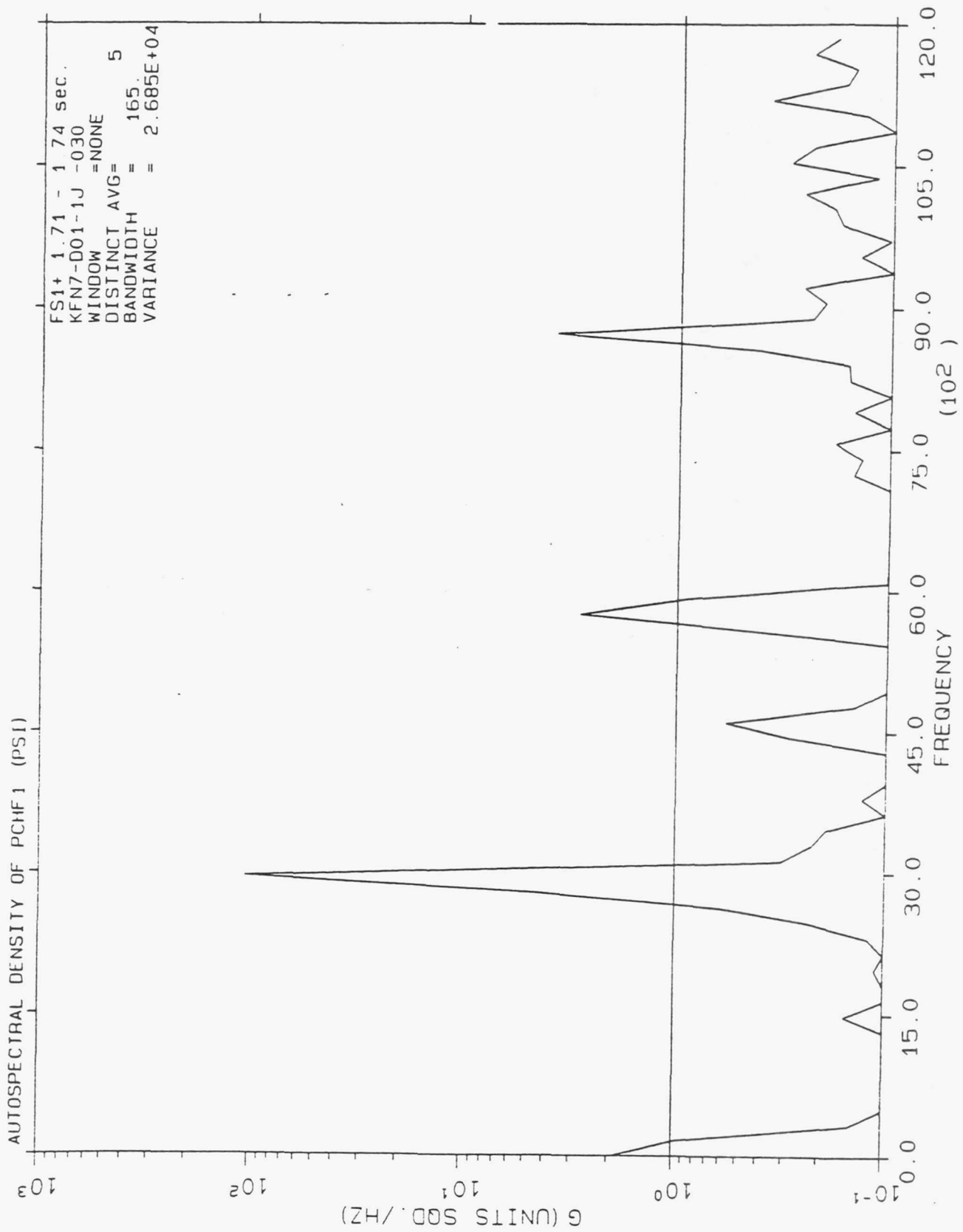




SPECTRA OF PCHF1 (PSI) . 19 SEGMENTS

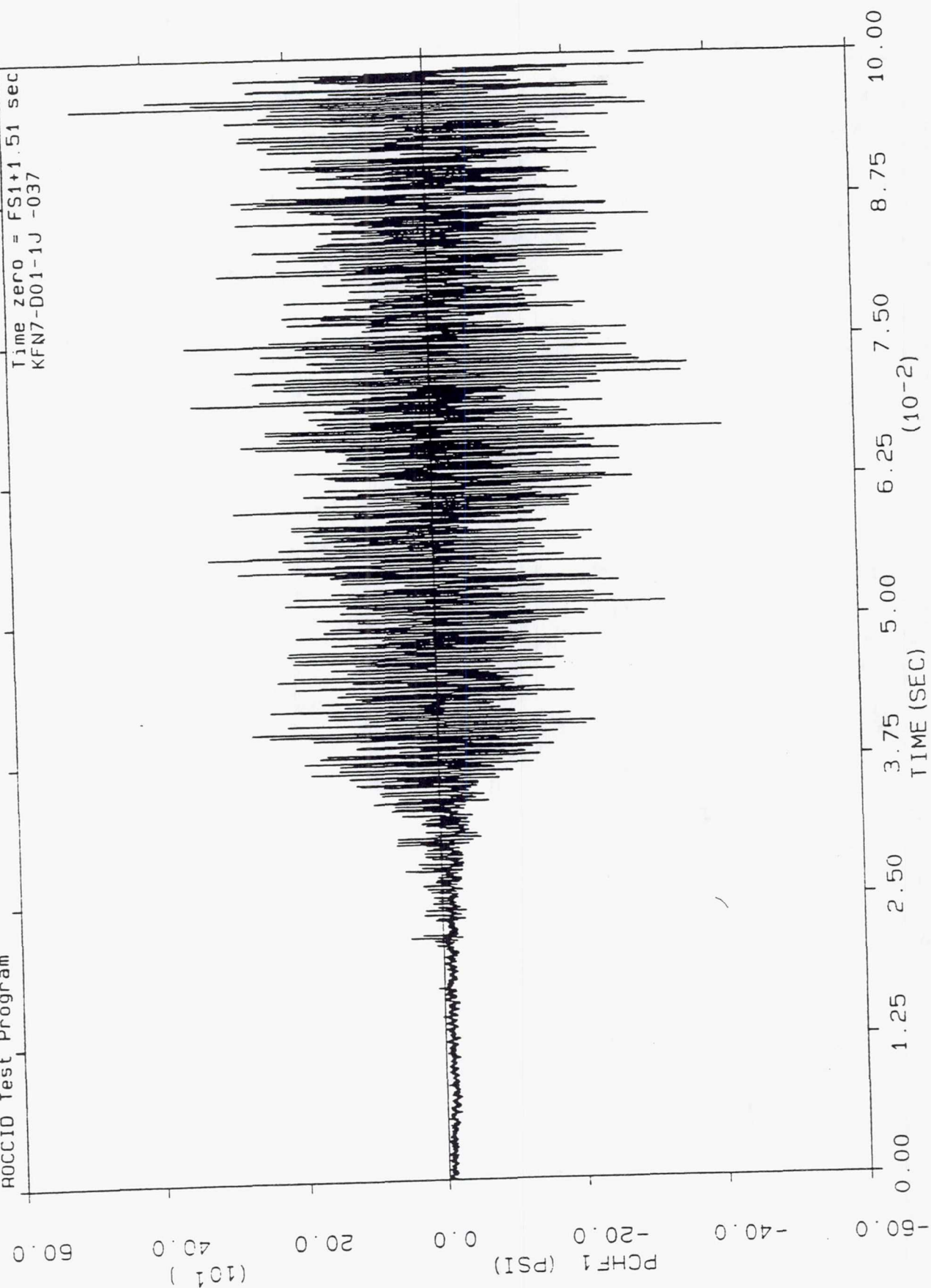
FS1+1.65 to FS1+1 75 sec
 KFN7-D01-1J -030
 SEGMENT TIME= 5.000E-03
 DAMPLITUDE = 10 0
 DI / SEGMENT= 200
 DI / SEGMENT= 6.32





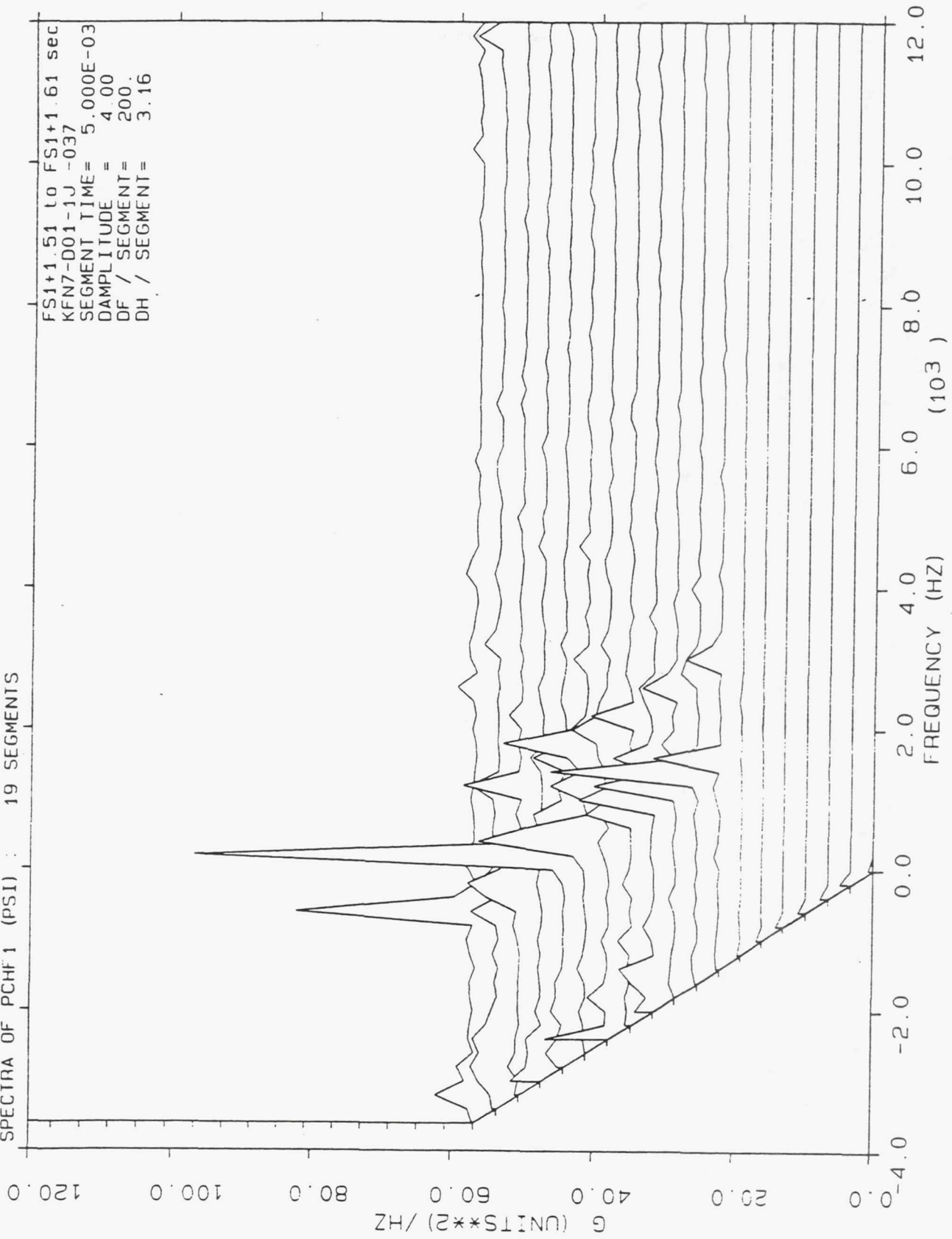
ROCCID Test Program

Time zero = FS1+1.51 sec
KFN7-D01-1J -037



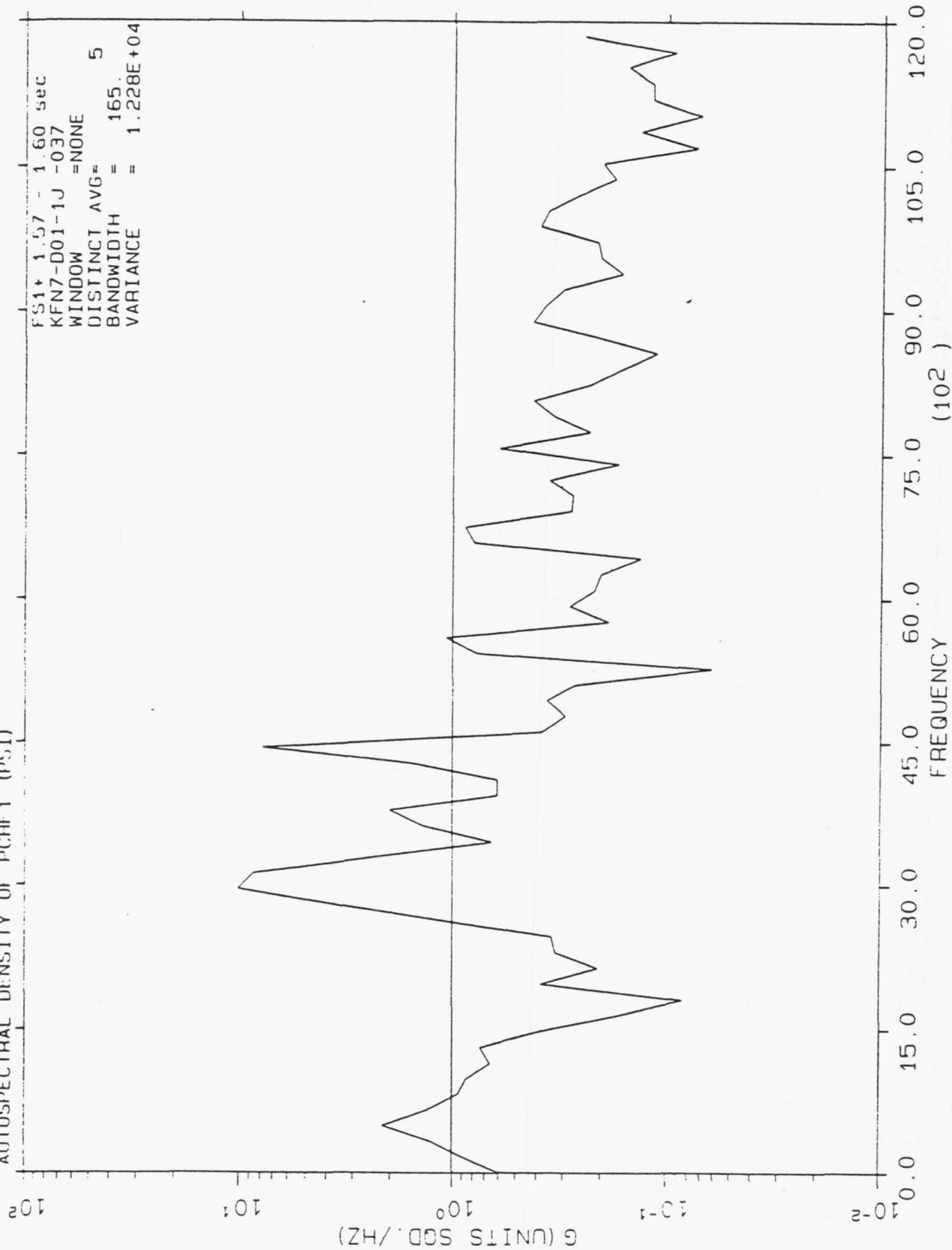
SPECTRA OF PCHF1 (PSI) : 19 SEGMENTS

FS1+1.51 to FS1+1.61 sec
 KFN7-001-1J -037
 SEGMENT TIME= 5.000E-03
 DAMPLITUDE = 4.00
 DF / SEGMENT= 200.
 DH / SEGMENT= 3.16



AUTOSPECTRAL DENSITY OF PCHF 1 (PSI)

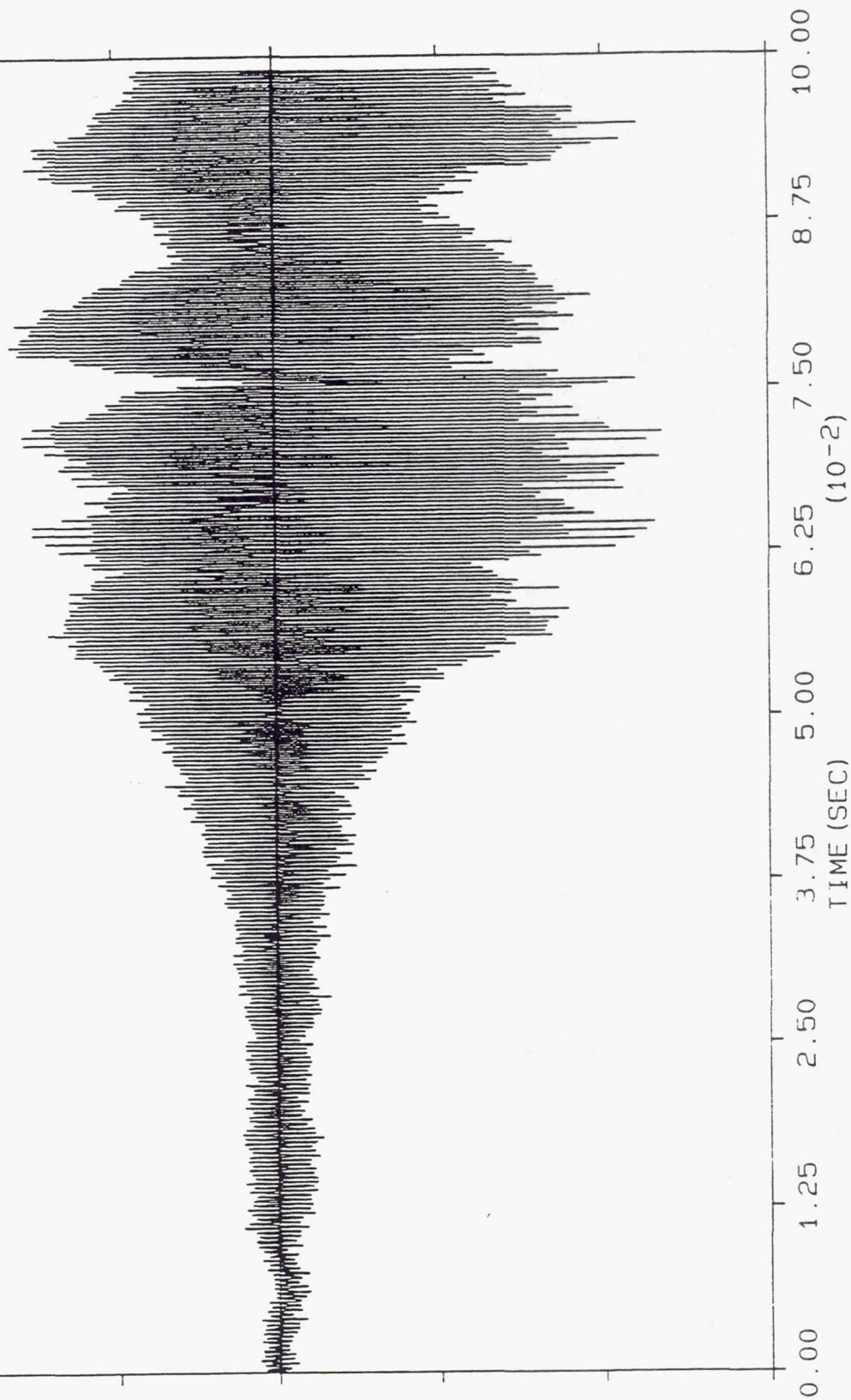
FS1+ 1.57 - 1.60 sec
KFN7-D01-1J -037
WINDOW =NONE
DISTINCT AVG= 5
BANDWIDTH = 165.
VARIANCE = 1.228E+04



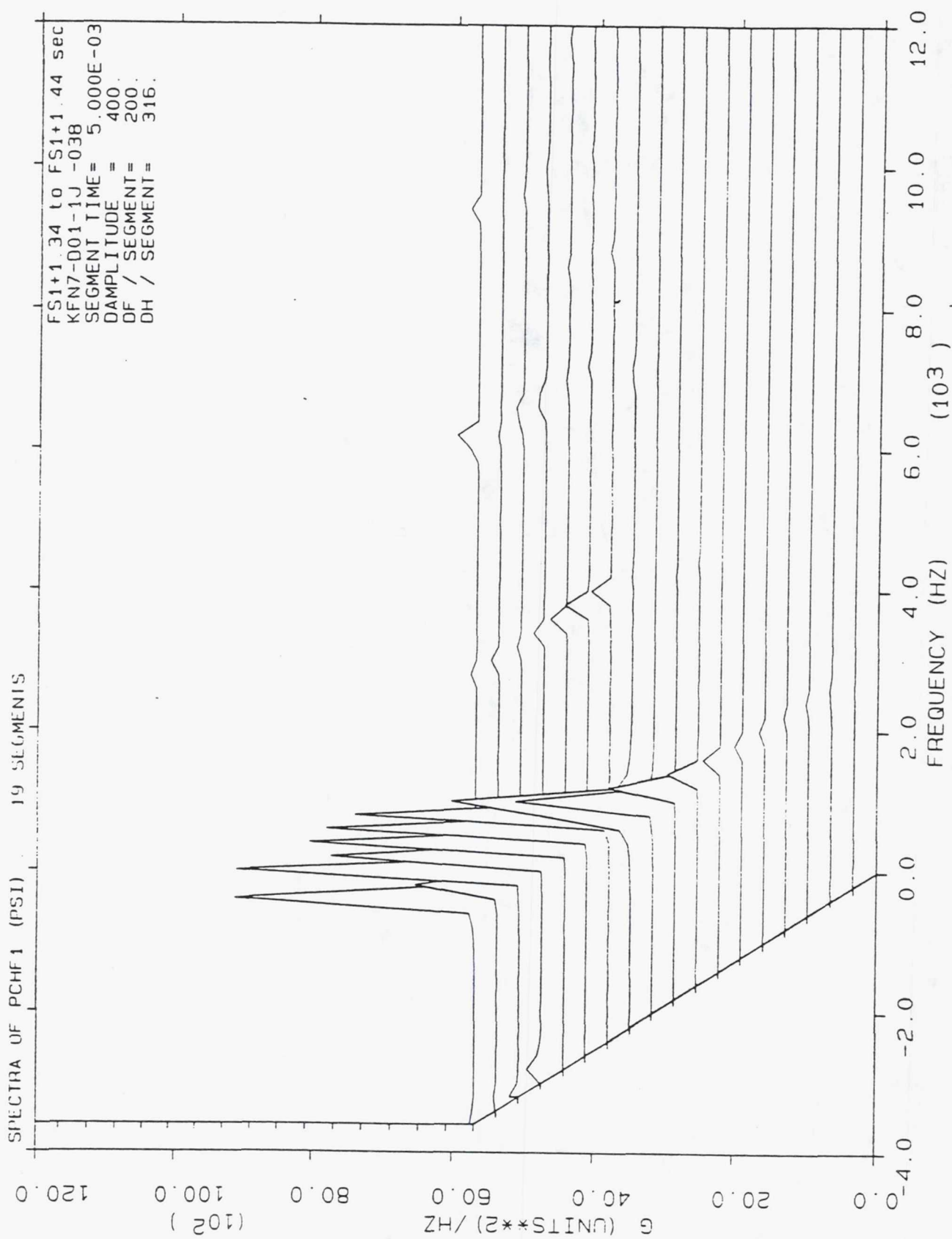
ROCCID Test Program

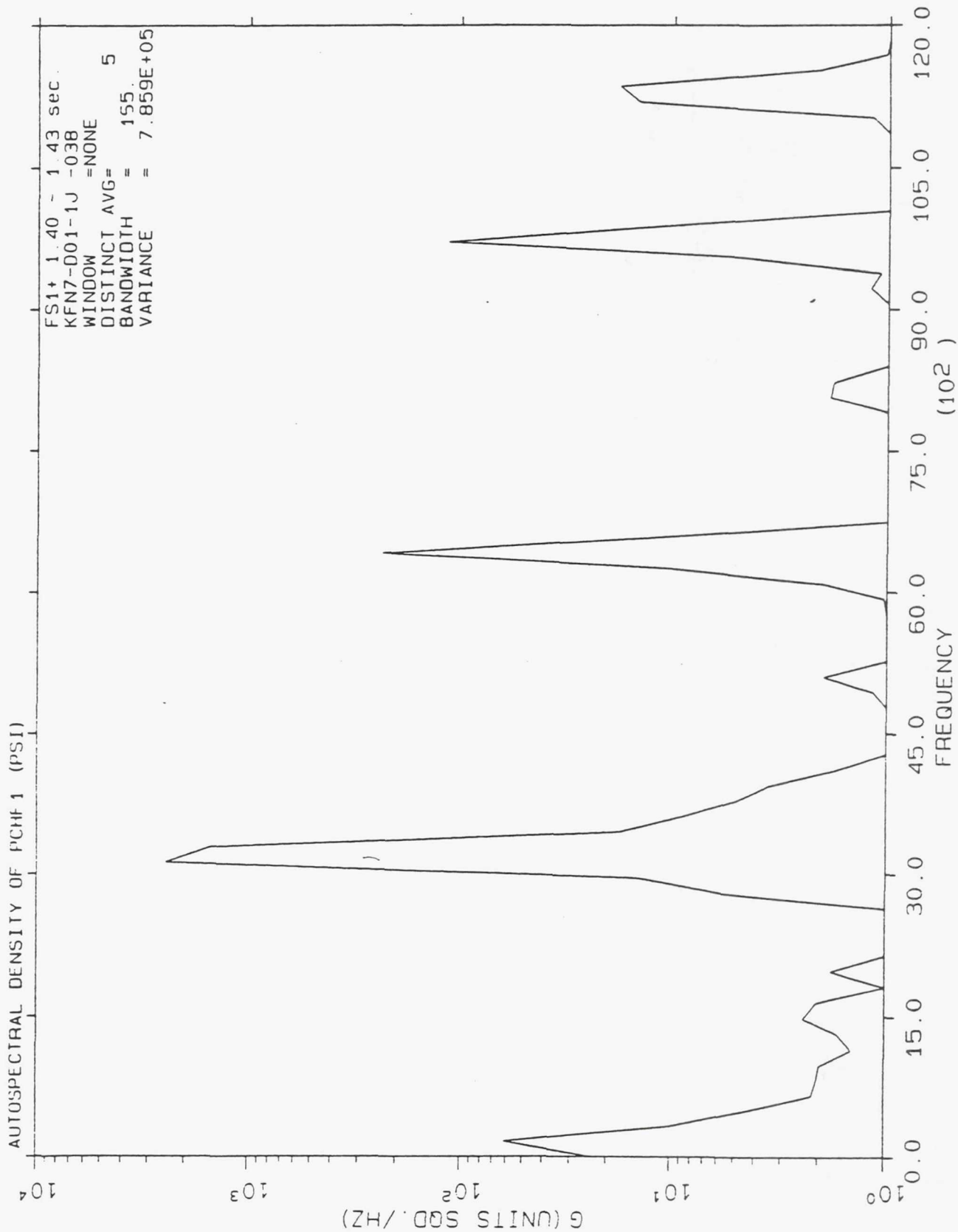
Time zero = FS1+1 34 sec
KFN7-D01-1J -038

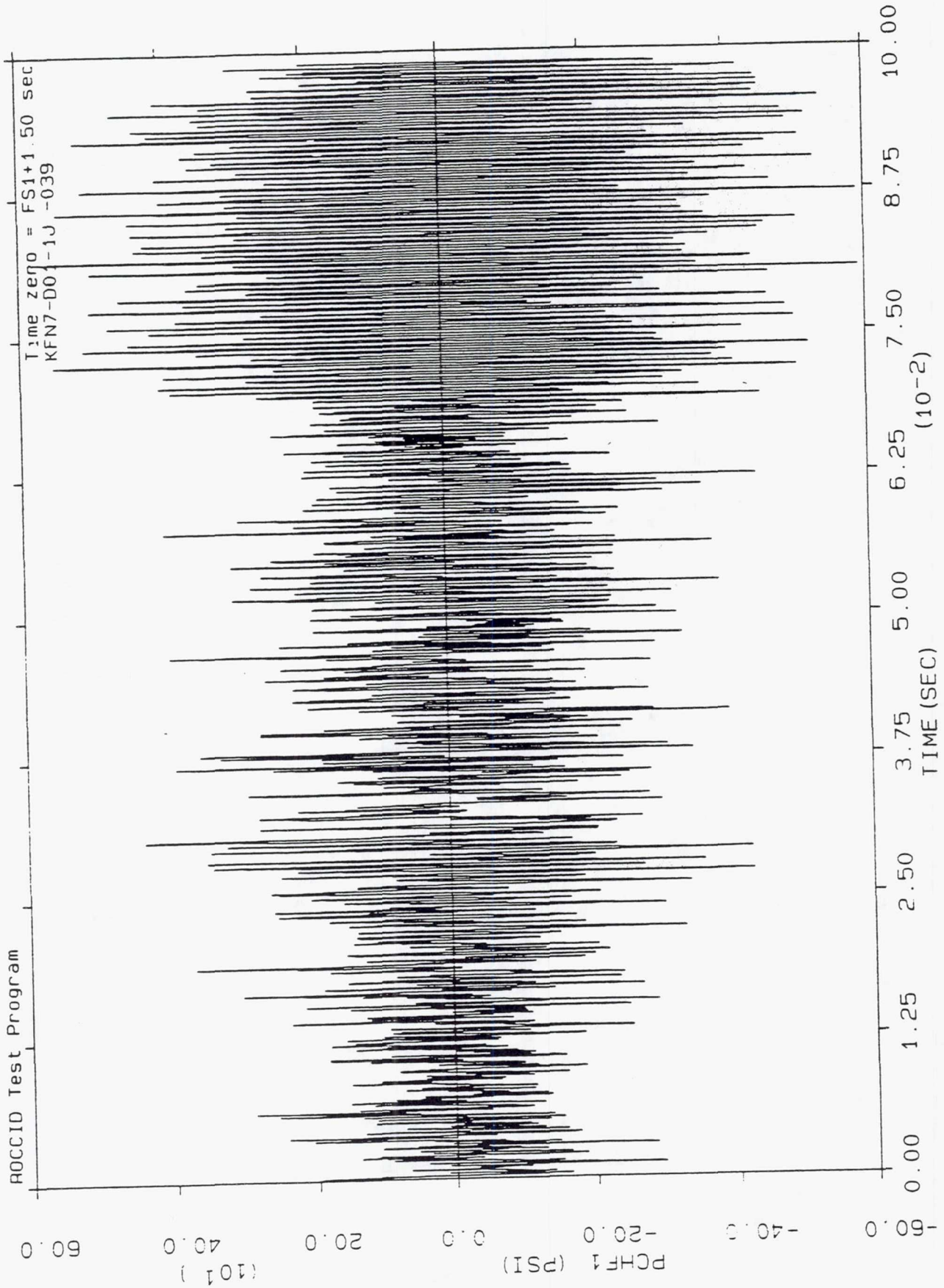
PCHF1 (PSI) (10²)

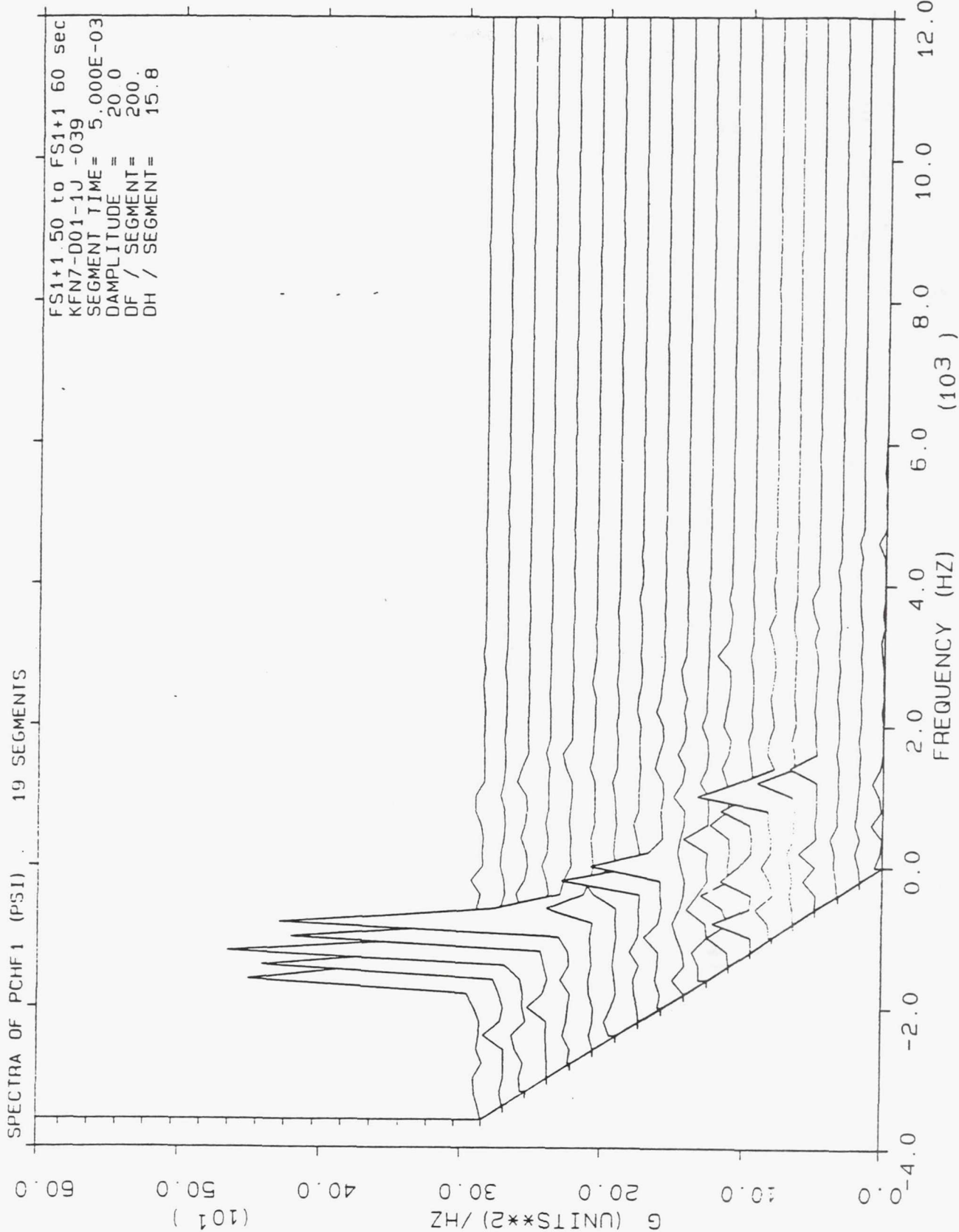


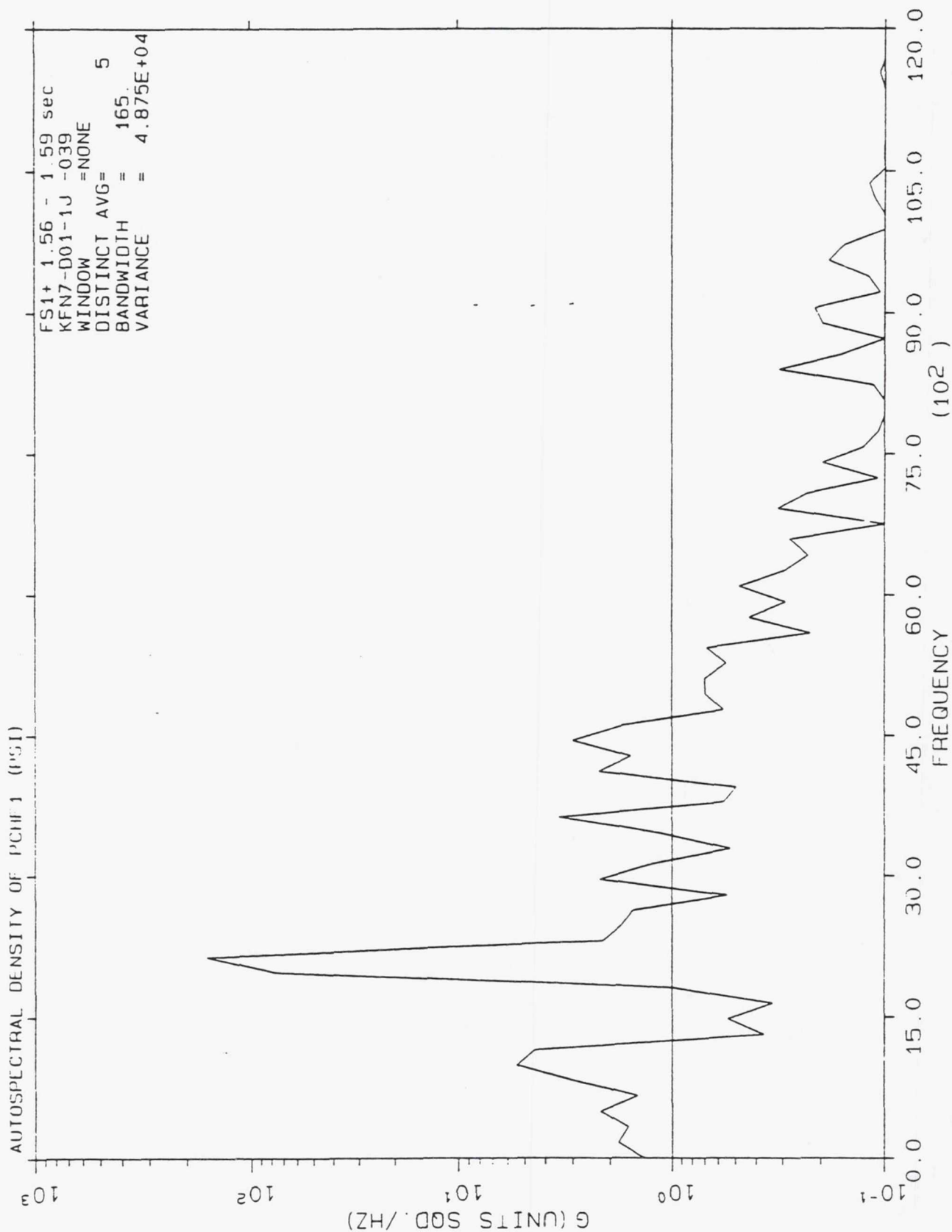
SPECTRA OF PCHF1 (PSI) 19 SEGMENTS





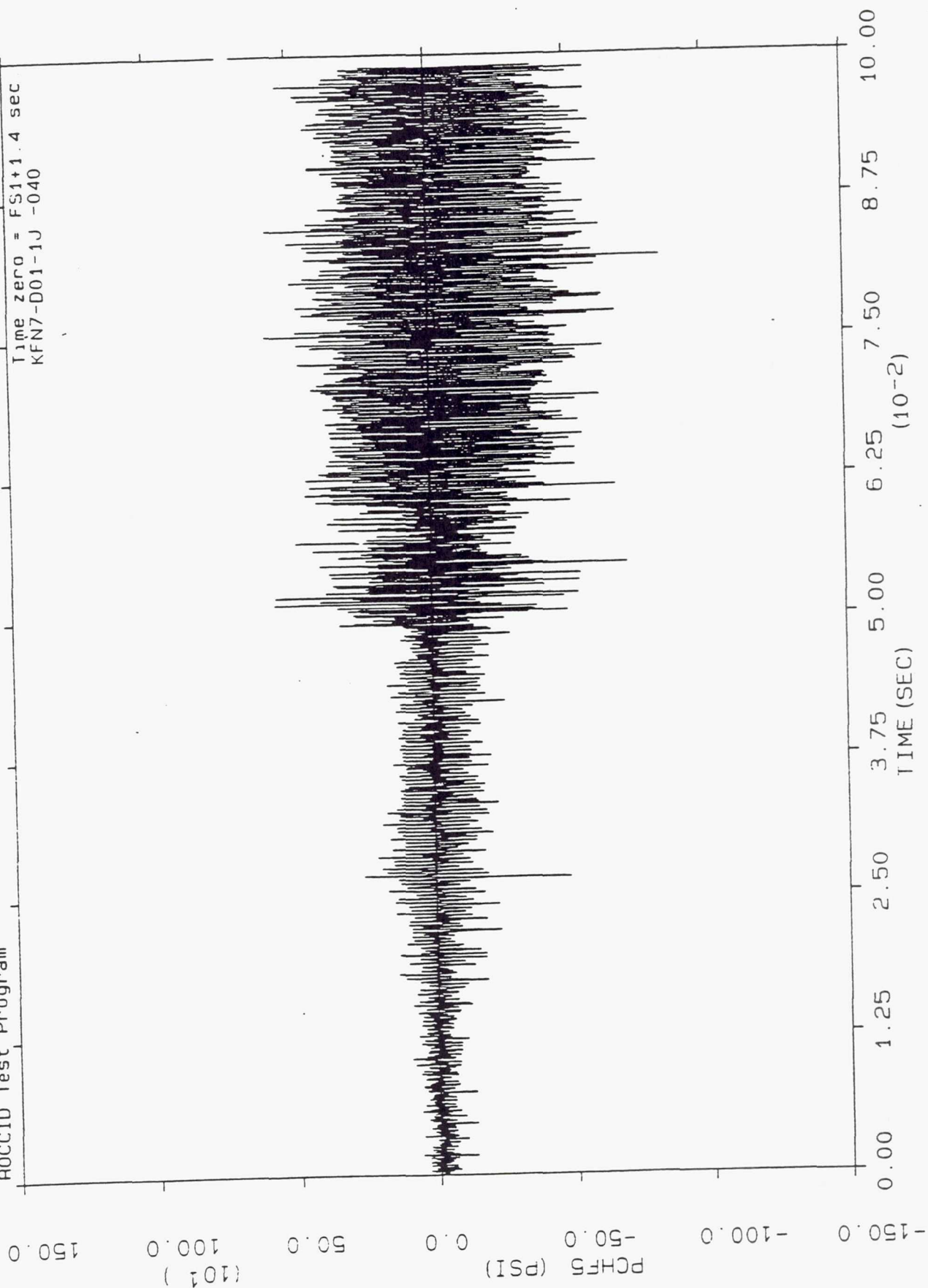




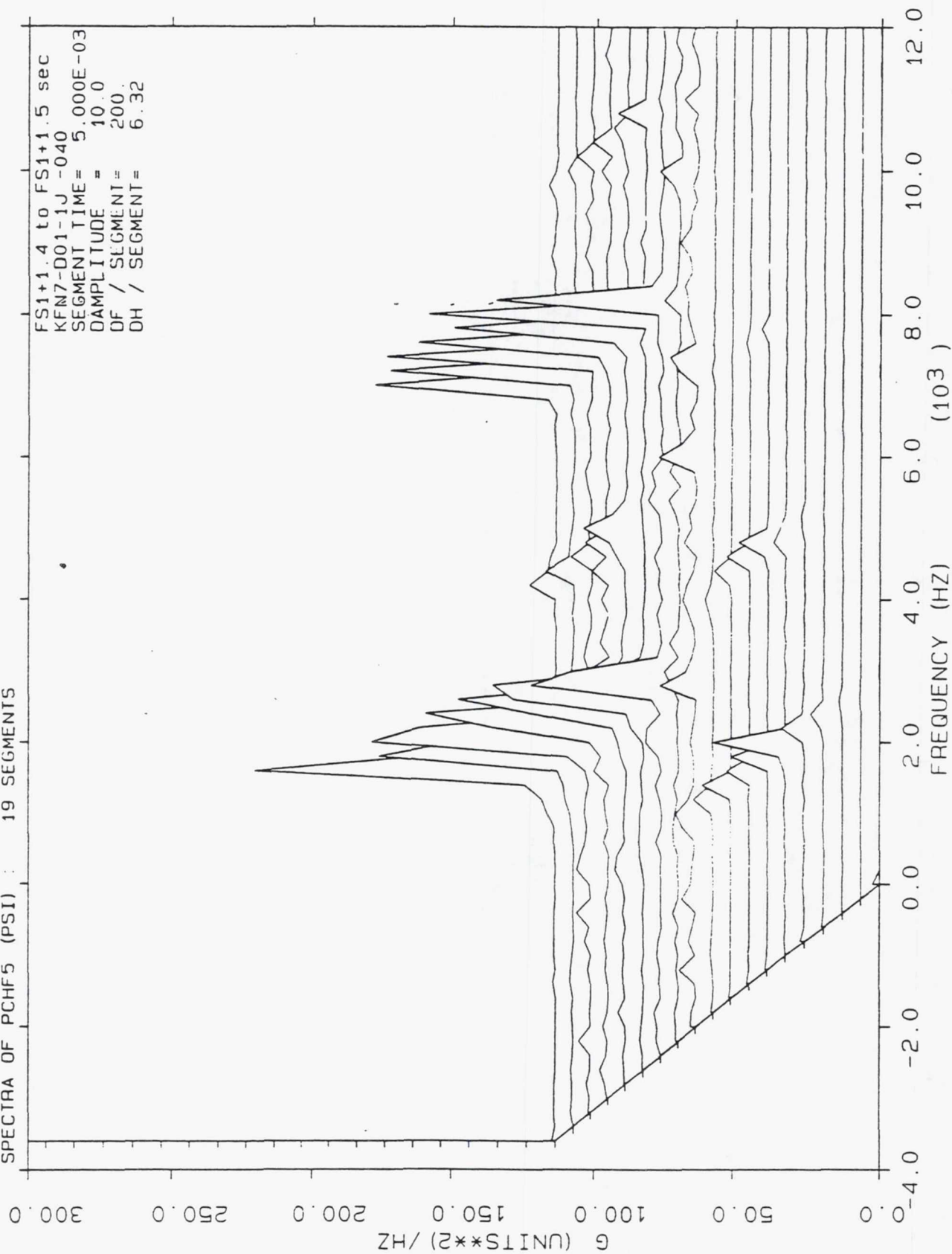


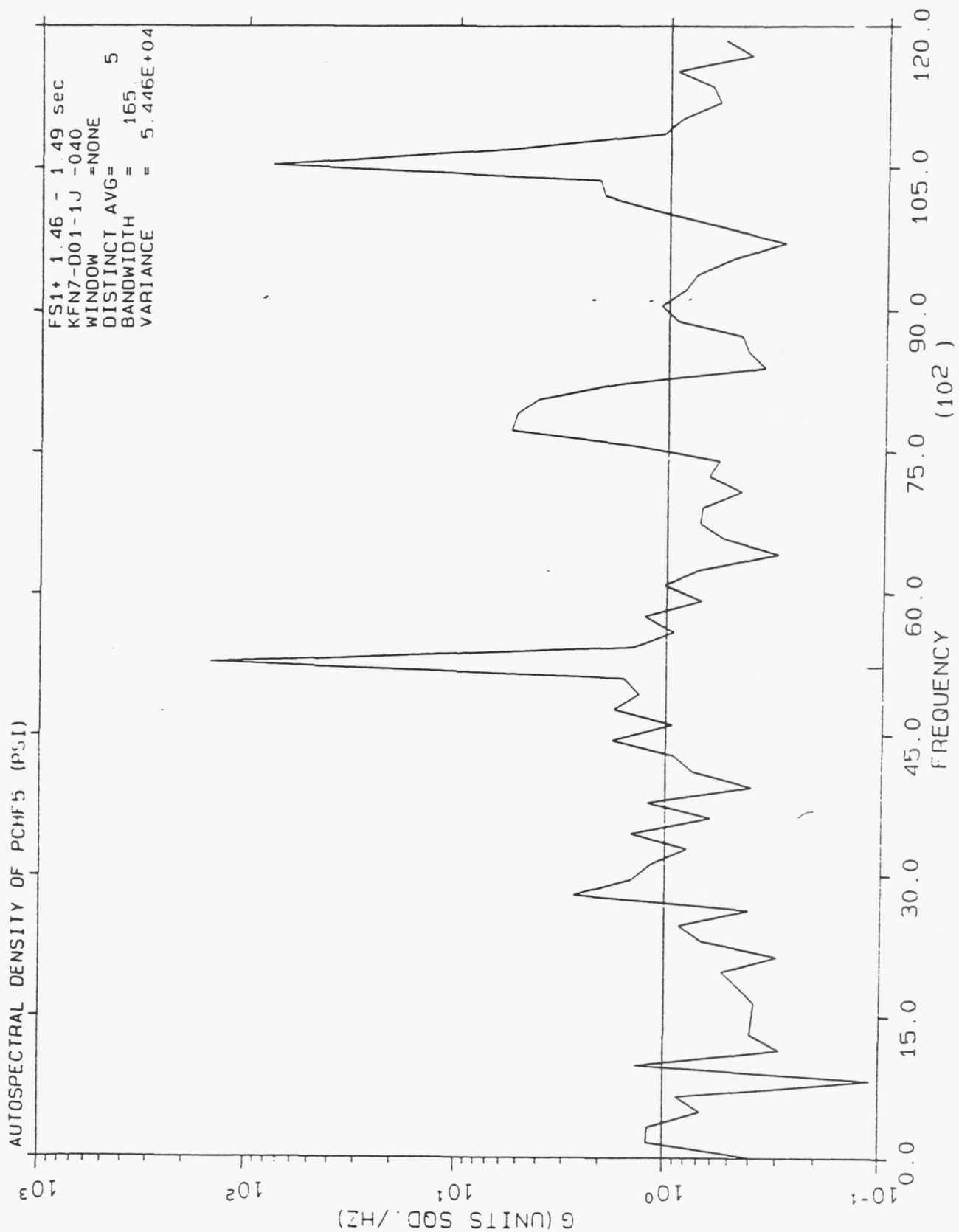
ROCCID Test Program

Time zero = FS1+1.4 sec
KFN7-D01-1J -040



SPECTRA OF PCHF5 (PSI) : 19 SEGMENTS





APPENDIX C

TIME SERIES, AMPLITUDE AND FREQUENCY EVOLUTION, AND POWER
SPECTRAL ANALYSIS OF MANIFOLD AND CHAMBER
PRESSURES AND ACCELERATIONS FOR TEST 004

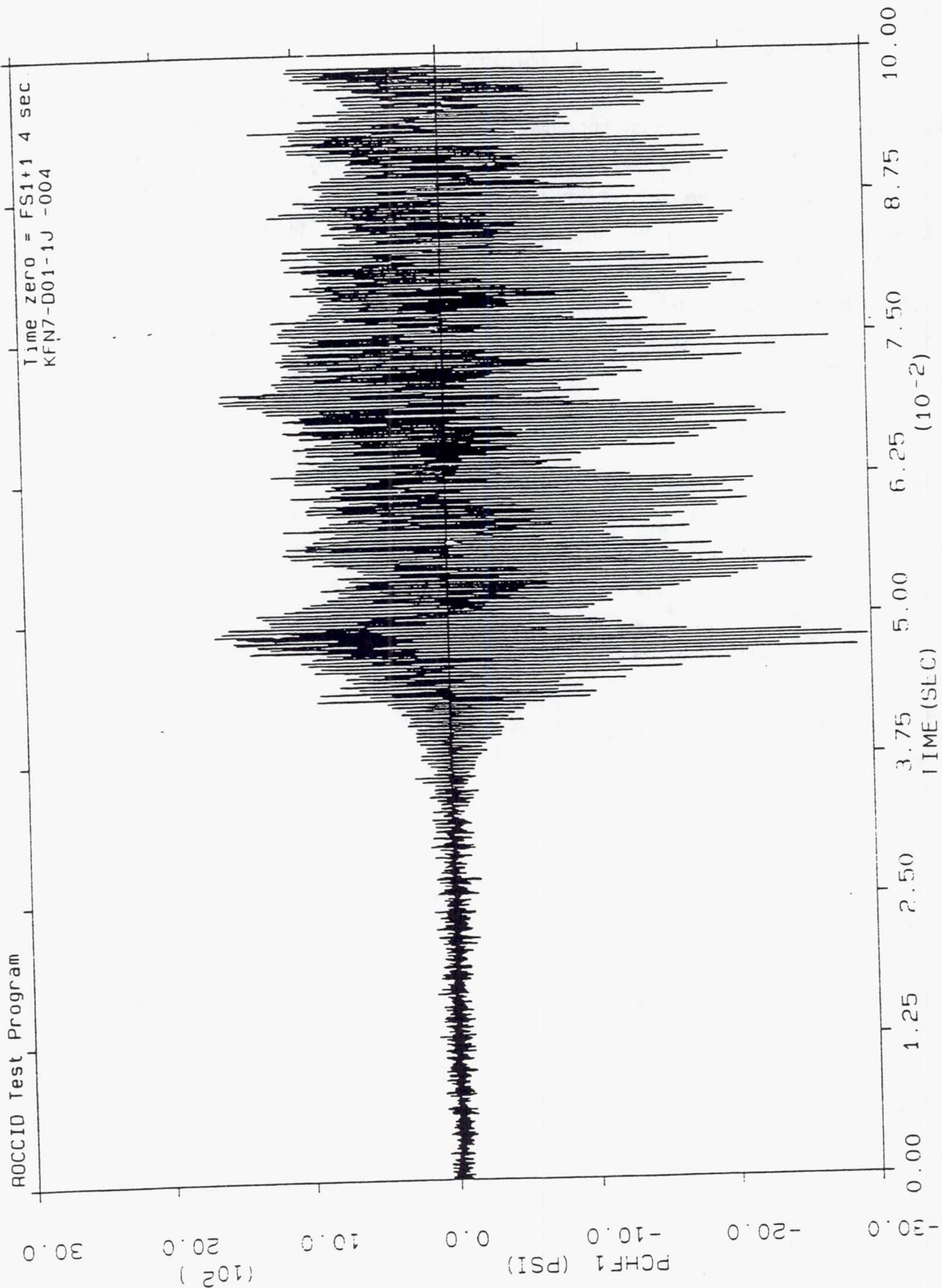
INDEX OF TEST DATA PLOTS
ALL DATA OBTAINED FROM TEST NO. KFN7-D01-1J-004

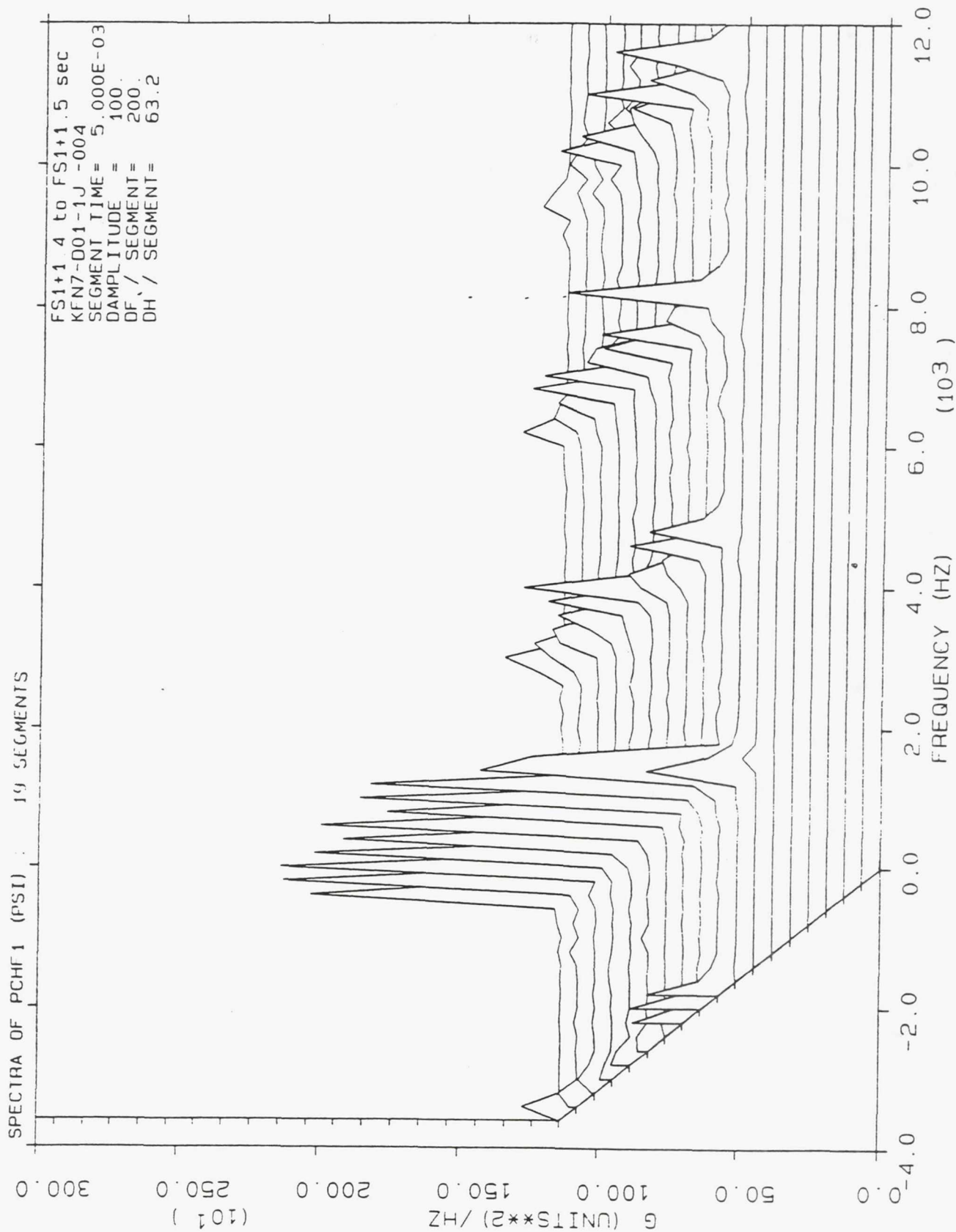
High Frequency Measurement Parameter	High Frequency Amplitude Versus Time Playback	Power Spectral Analysis	Power Spectral Density
(Page Nos. for Specific Plot for Each Parameter)			
PCHF-1	C-2	C-3	C-4
PCHF-2	C-5	C-6	C-7
PCHF-3	C-8	C-9	C-10
PCHF-4	C-11	C-12	C-13
PCHF-5	C-14	C-15	C-16
POJHF	C-17	C-18	C-19
PFJHF	C-20	C-21	C-22
AX	C-23	C-24	C-25
AY	C-26	C-27	C-28
AZ	C-29	C-30	C-31

<u>Symbol</u>	<u>Parameter Definition</u>
PCHF	High Frequency Chamber Pressure (PSI)
POJHF	High Frequency LOX Injector Manifold Pressure (PSI)
PFJHF	High Frequency RP-1 Injector Manifold Pressure (PSI)
AX	Accelerometer X Axis (g's)
AY	Accelerometer Y Axis (g's)
AZ	Accelerometer Z Axis (g's)

FOREWORD

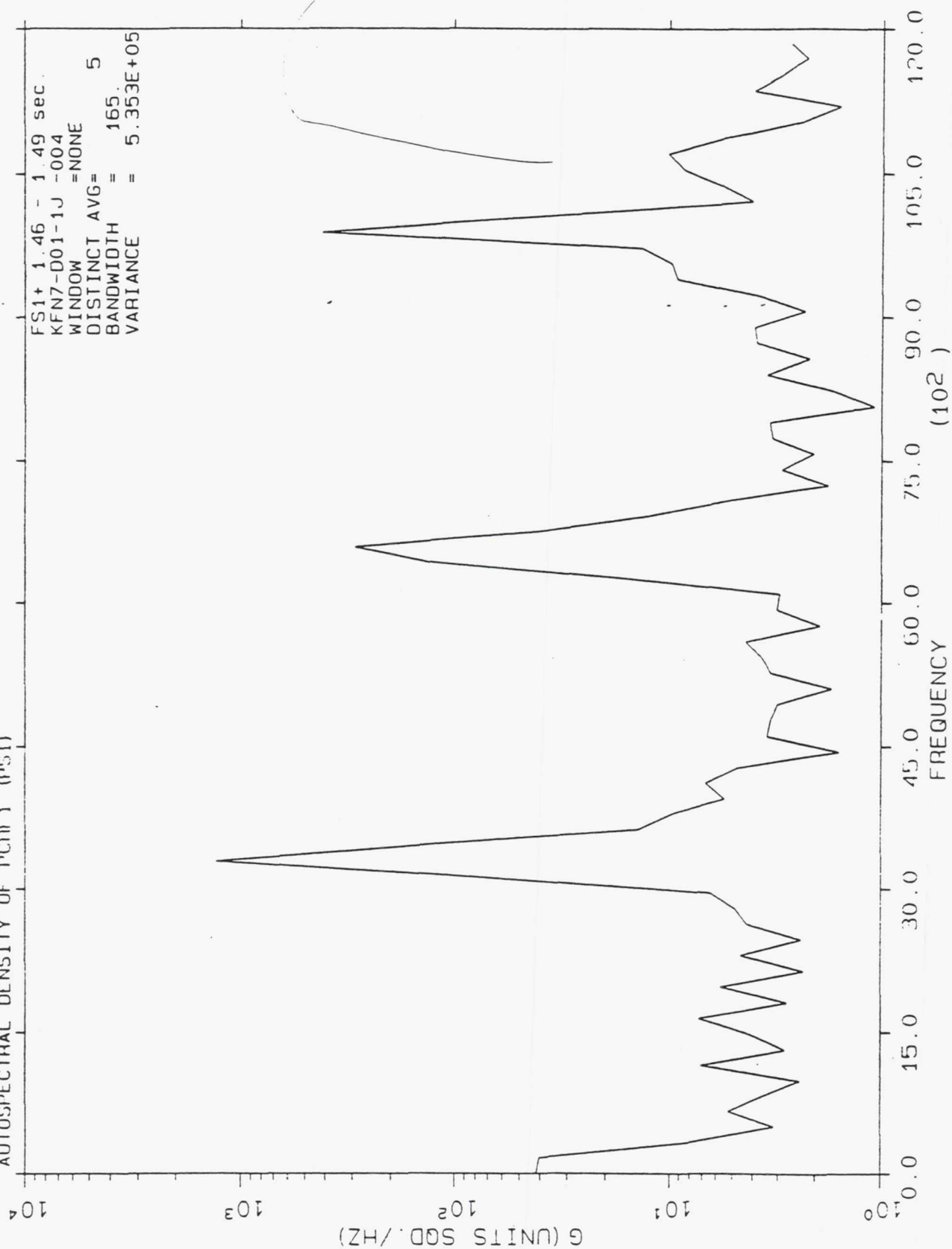
Included in this appendix is a complete display of high frequency measurements obtained during test KFN7-D01-1J-004. A total of 10 parameters are displayed including five high frequency chamber pressure measurements (see Figure 51 of Volume I for measurement locations), one each high frequency pressure measurements located in the injector manifold inlet pipes of the fuel and oxidizer circuits, and three accelerometer recordings obtained from a tri-axial accelerometer mounted on the injector assembly. High frequency amplitude versus time, power spectral analysis and power spectral density plots for each of the 10 parameters are included. The plot formats are the same as those described in Appendix B.





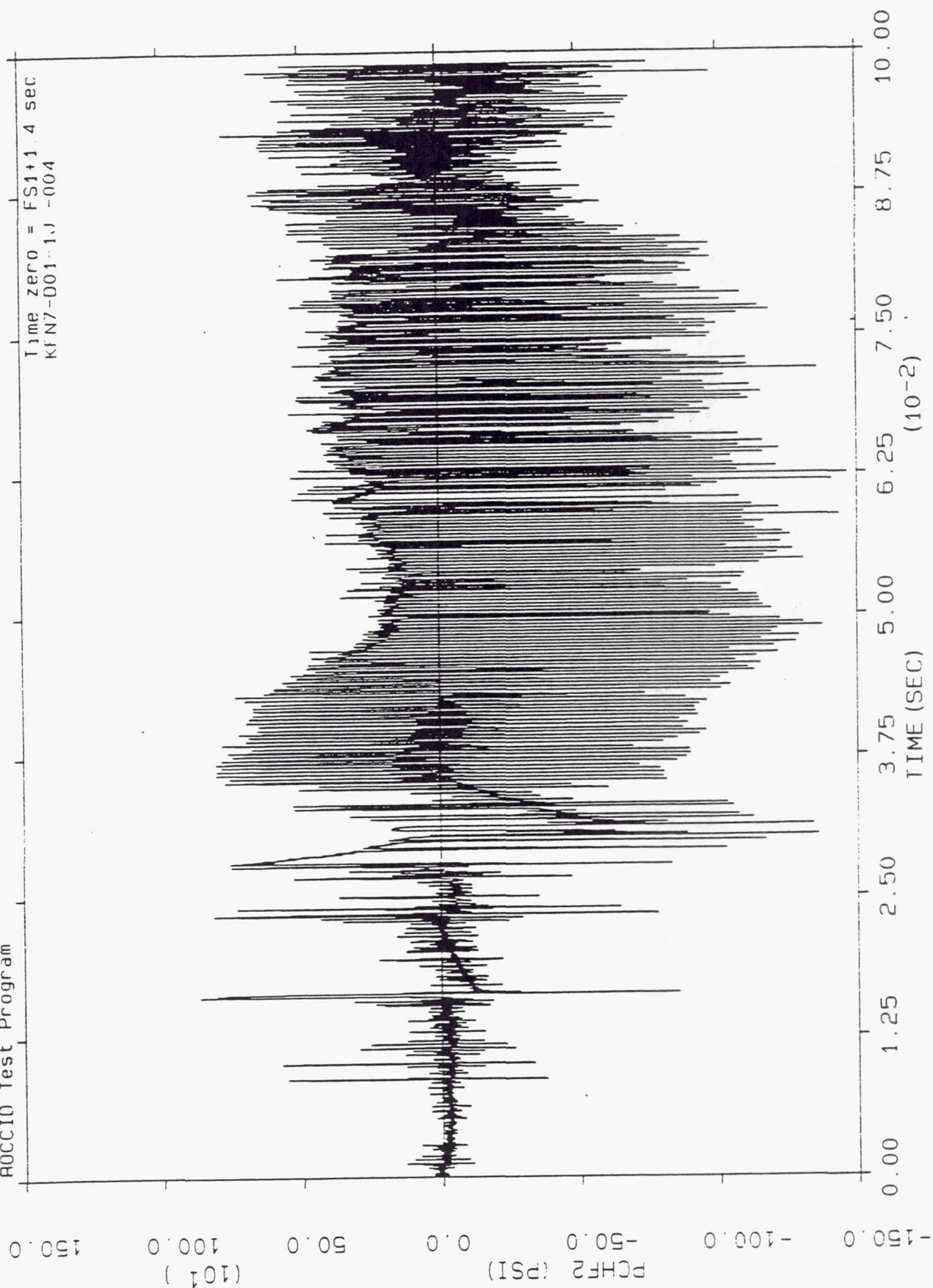
AUTOSPECTRAL DENSITY OF PCH 1 (P51)

FS1+ 1.46 - 1.49 sec.
KFN7-D01-1J -004
WINDOW =NONE
DISTINCT AVG= 5
BANDWIDTH = 165.
VARIANCE = 5.353E+05



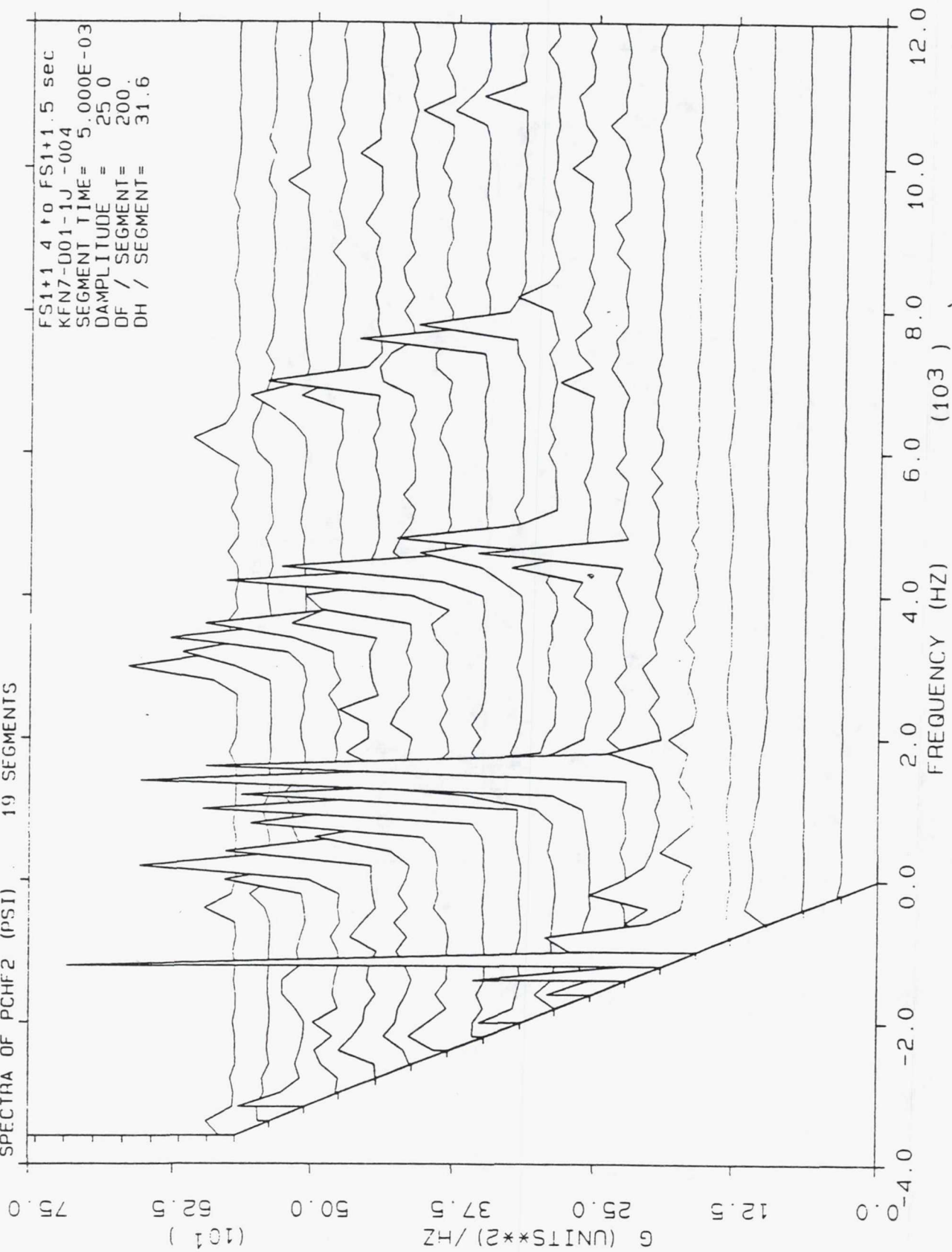
ROCCID Test Program

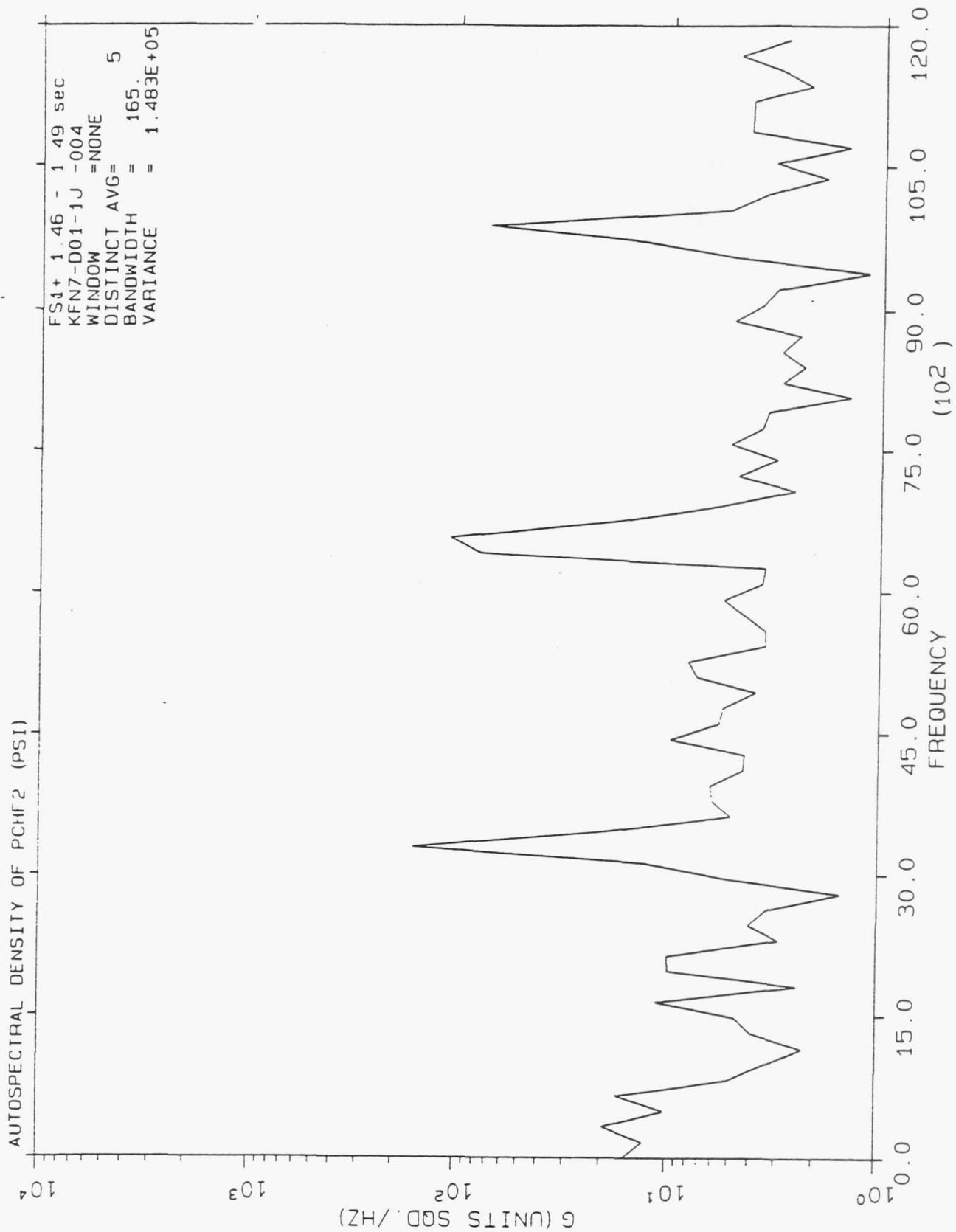
Time zero = FS1+1.4 sec
KF N7-D01-1J -004



SPECTRA OF PCHF2 (PSI) 19 SEGMENTS

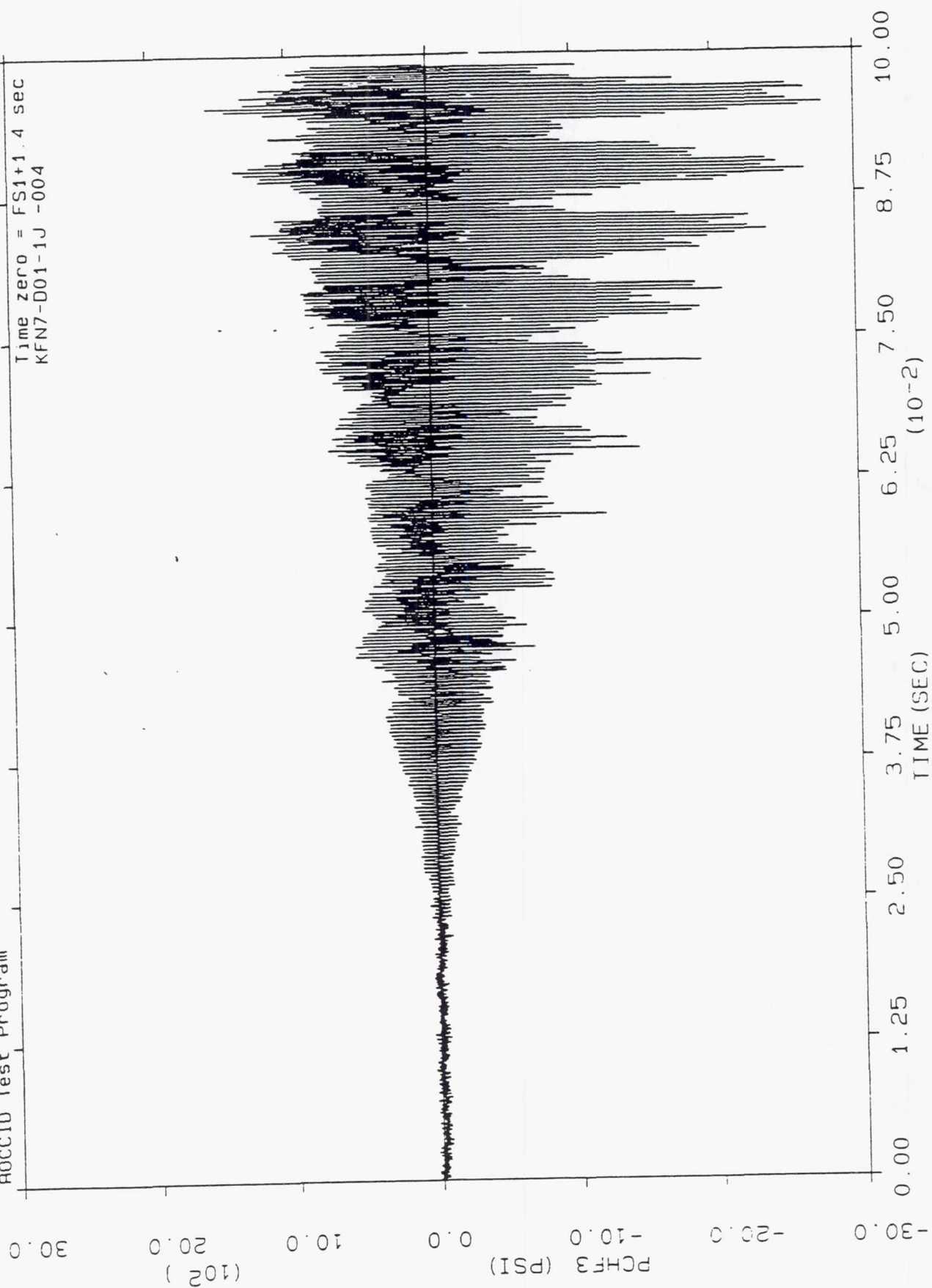
FS1+1 4 to FS1+1.5 sec
 KFN7-001-1J -004
 SEGMENT TIME= 5.000E-03
 DAMPLITUDE = 25 0
 DF / SEGMENT= 200.
 DH / SEGMENT= 31.6





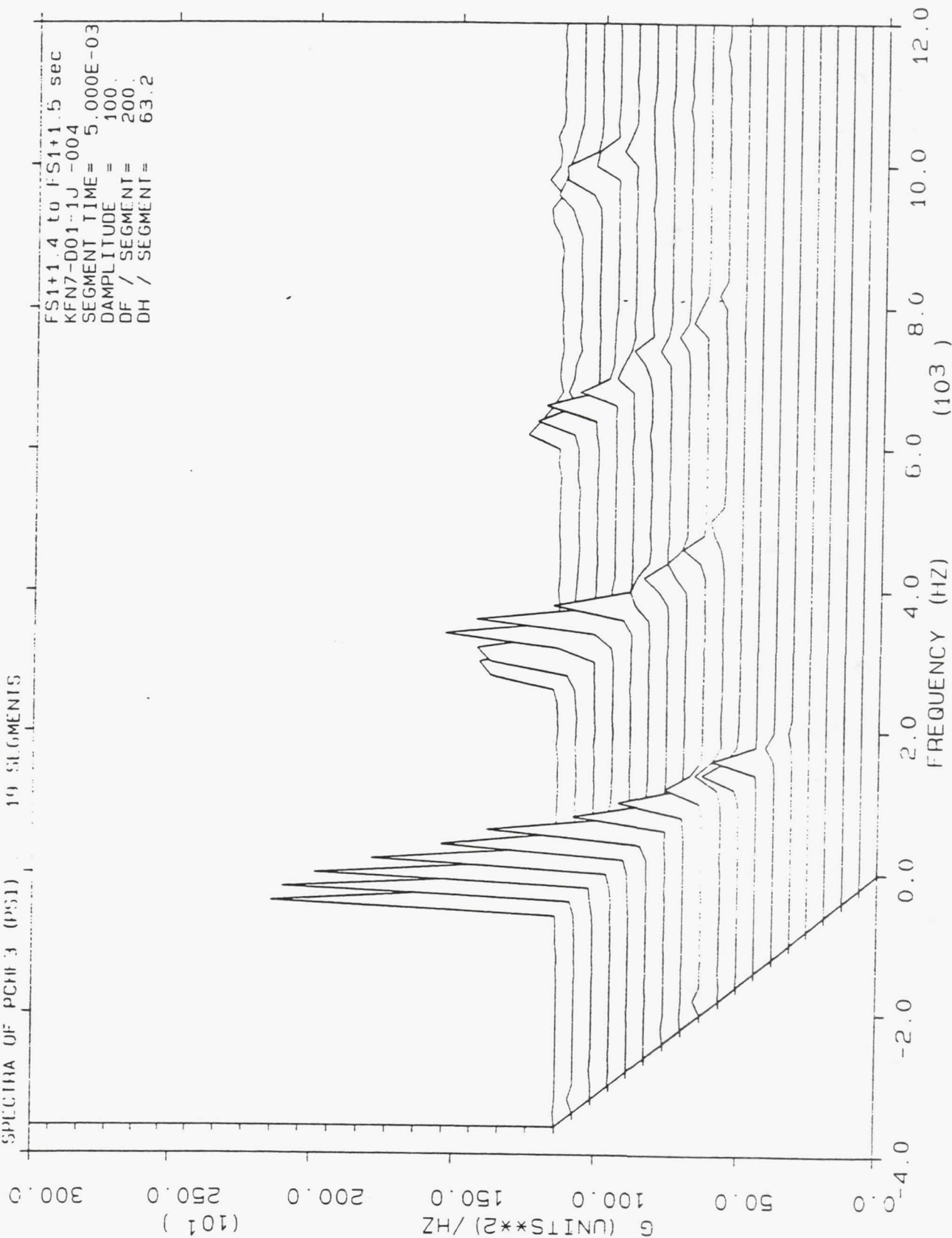
ROCC10 Test Program

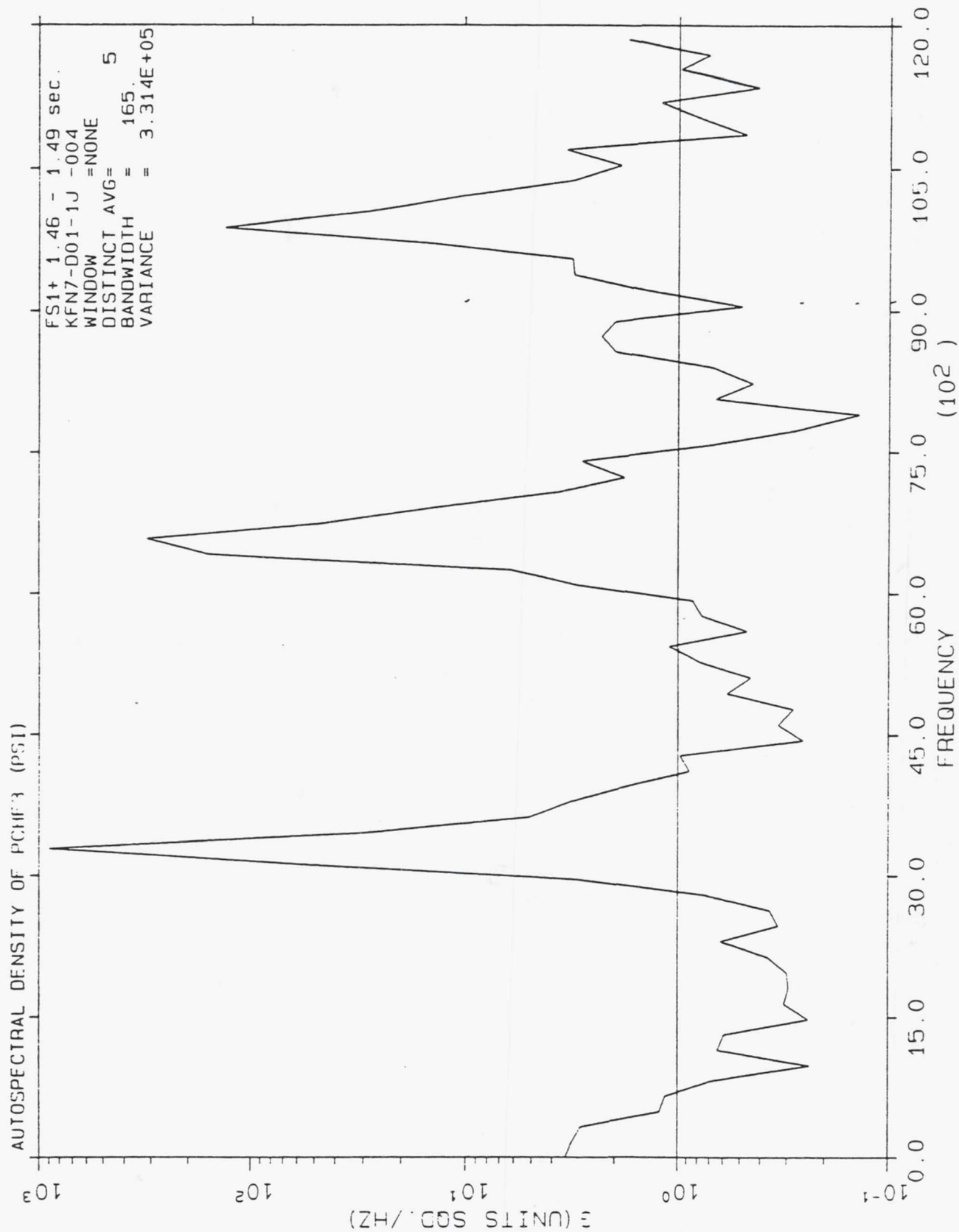
Time zero = FS1+1.4 sec
KFN7-D01-1J -004



SPECTRA OF PCH 3 (PS1) 10 SEGMENTS

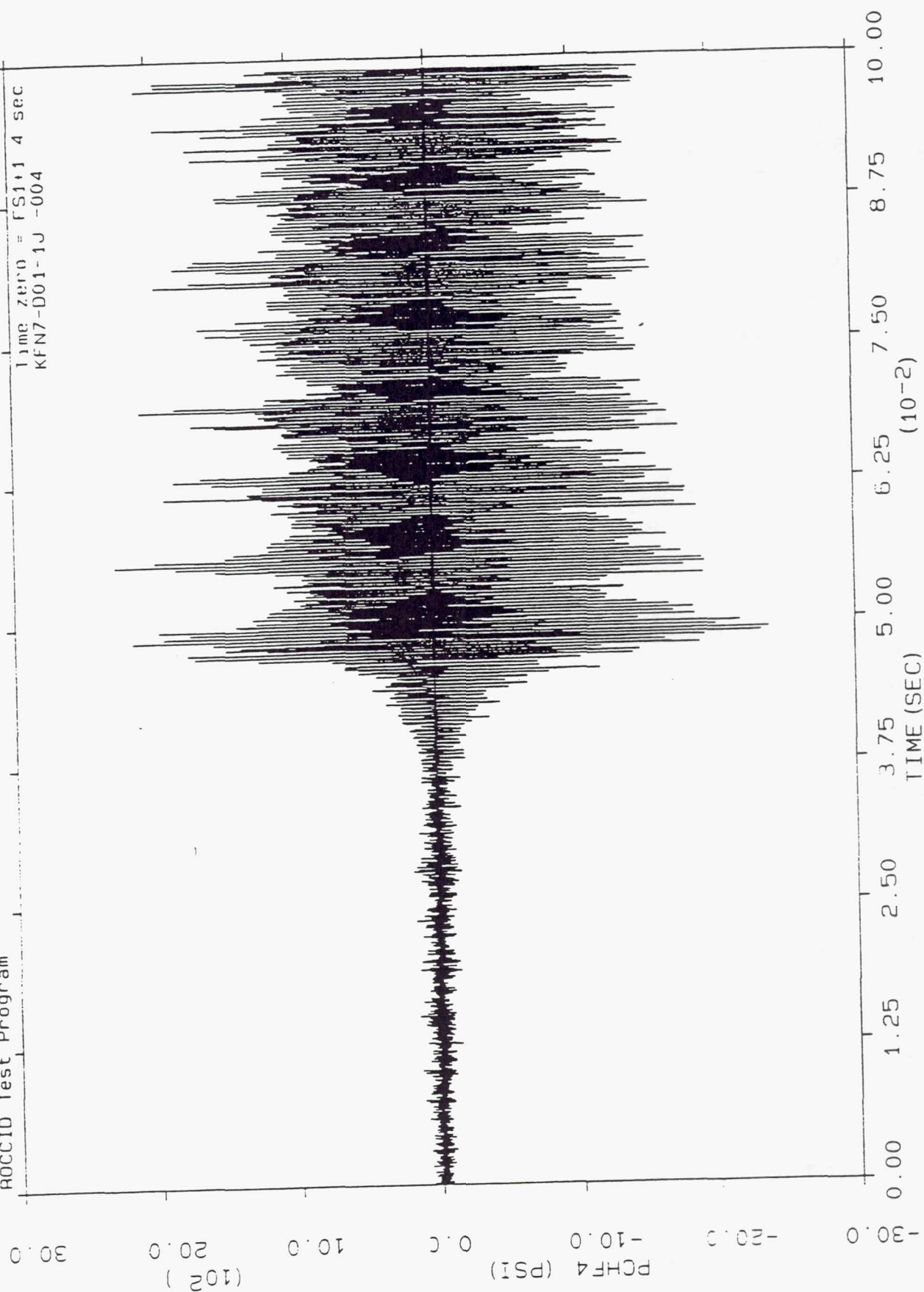
FS1+1.4 to FS1+1.5 sec
 KFN7-D01-1J -004
 SEGMENT TIME= 5.000E-03
 DAMPLITUDE = 100.
 DF / SEGMENT= 200.
 DH / SEGMENT= 63.2





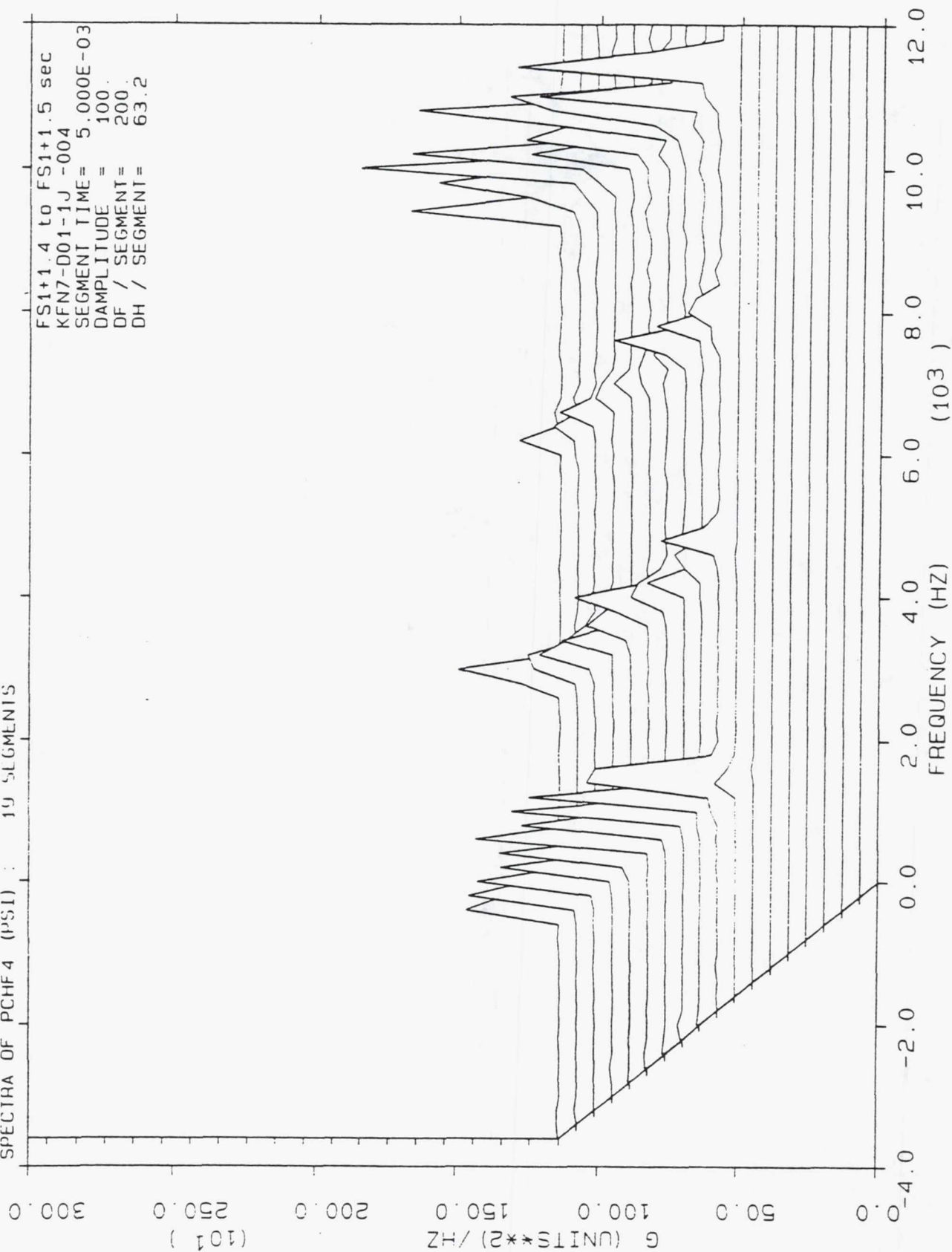
ROCCID Test Program

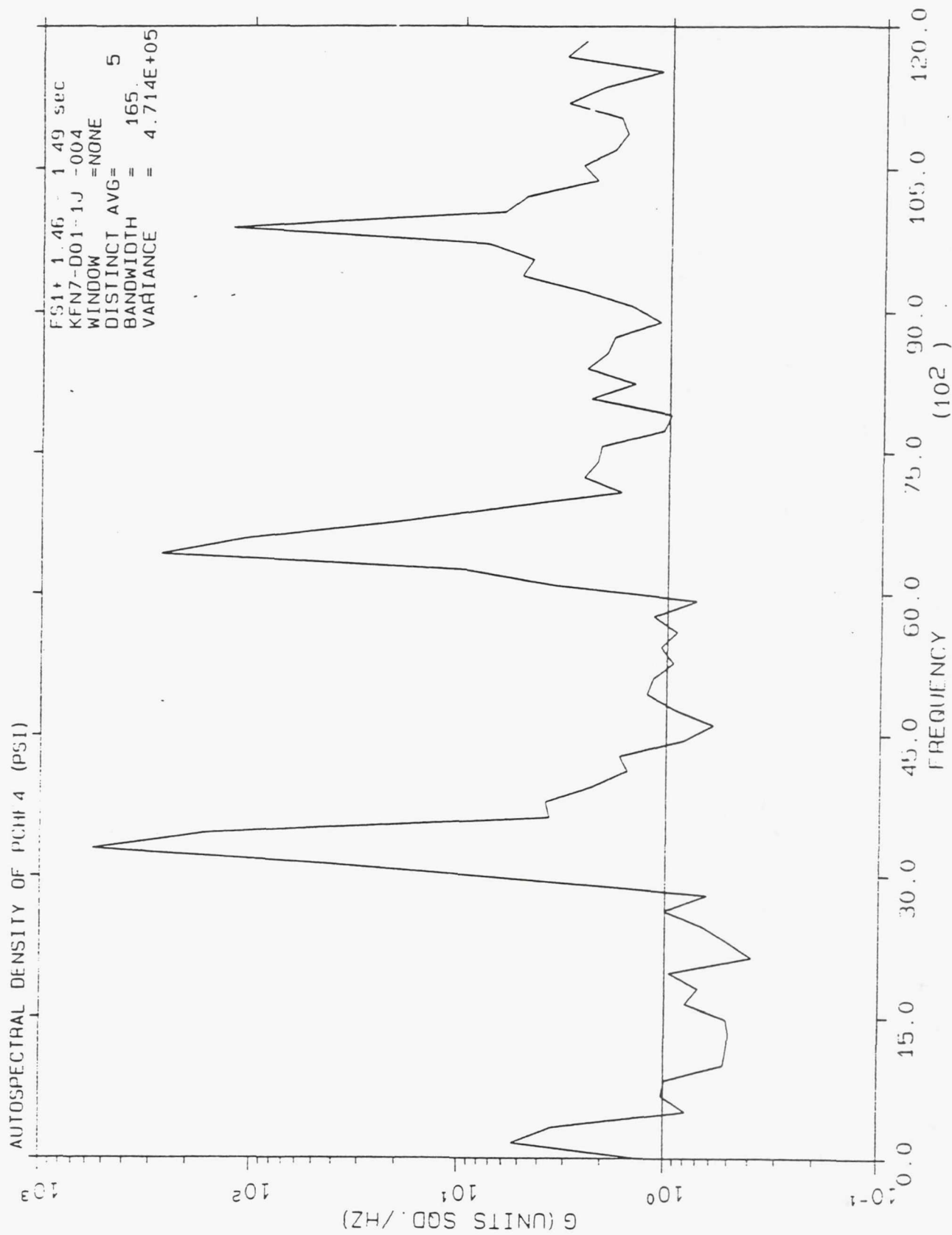
Time zero = FS11 4 sec
KFN7-D01-1J -004



SPECTRA OF PCHF4 (PSI) : 19 SEGMENTS

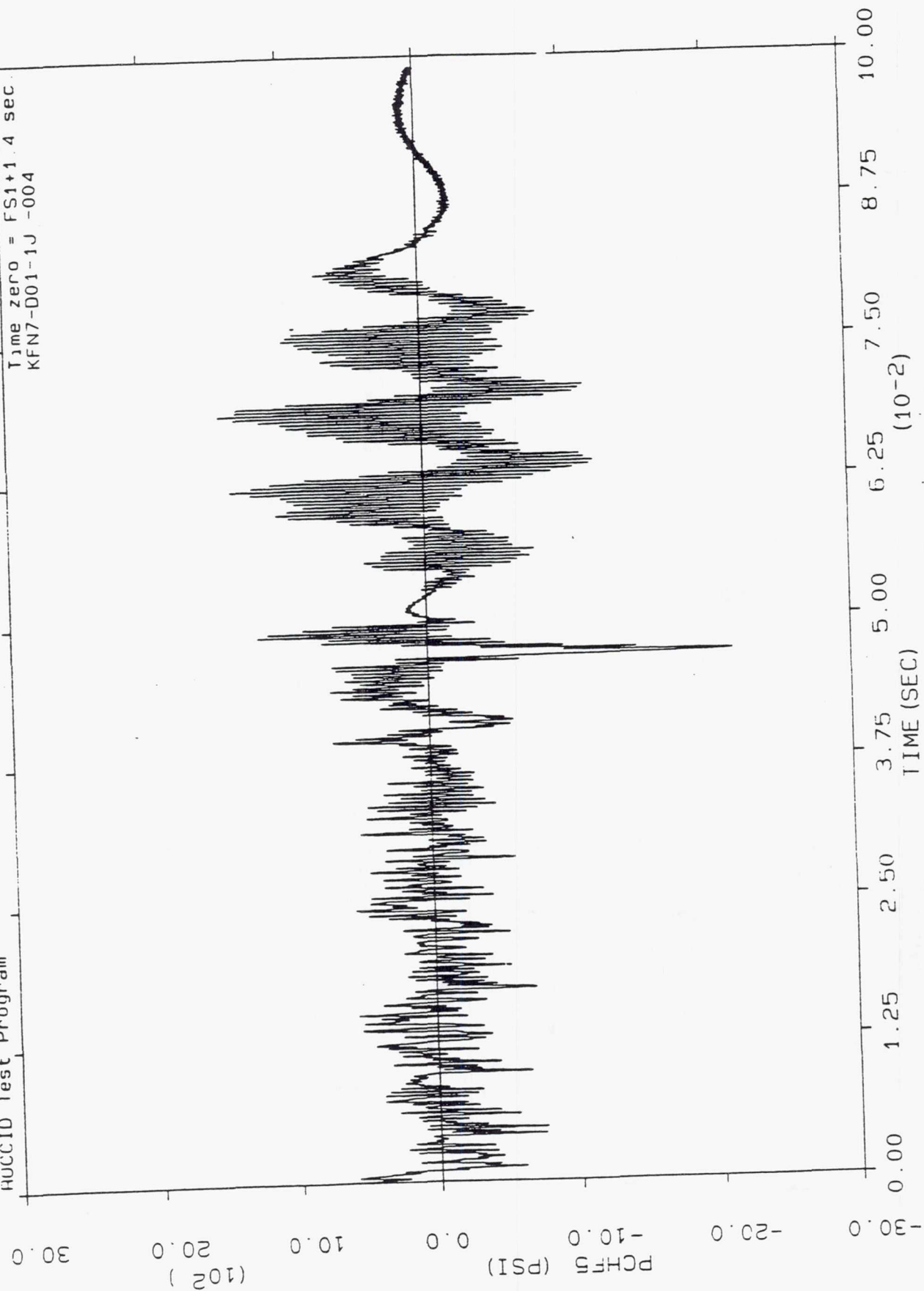
FS1+1.4 to FS1+1.5 sec
 KFN7-001-1J -004
 SEGMENT TIME= 5.000E-03
 DAMPLITUDE = 100.
 DF / SEGMENT= 200.
 DH / SEGMENT= 63.2



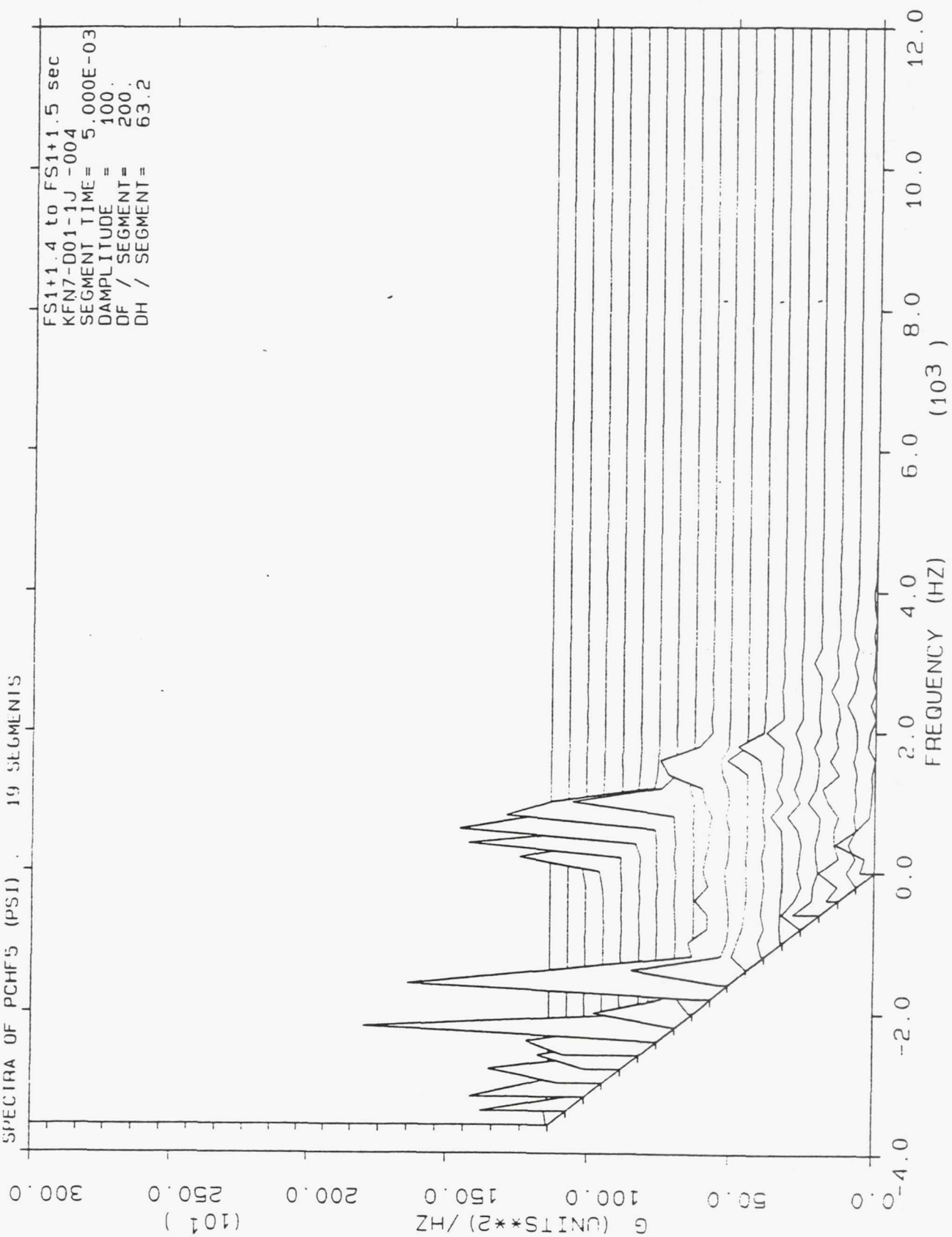


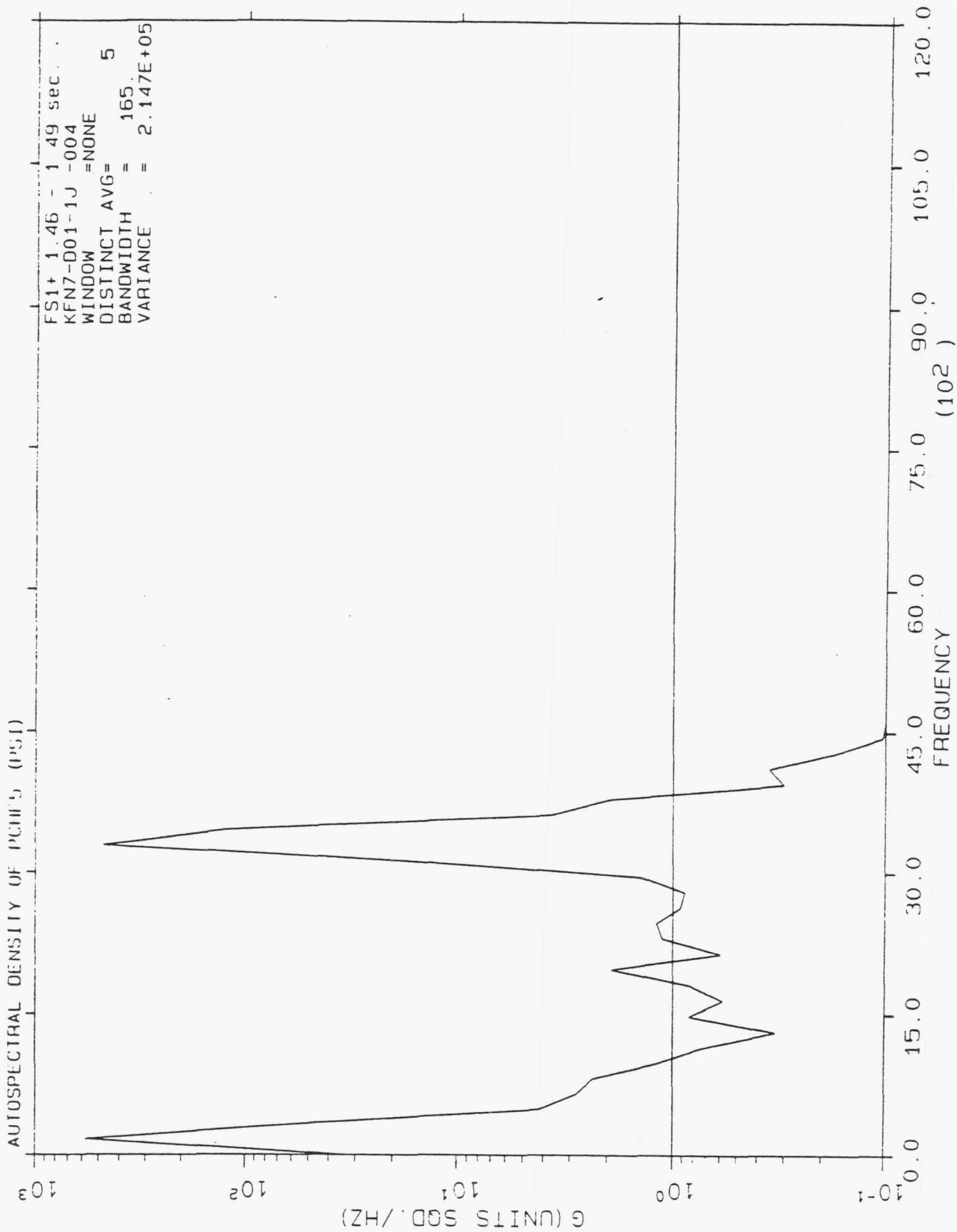
HUCCID Test Program

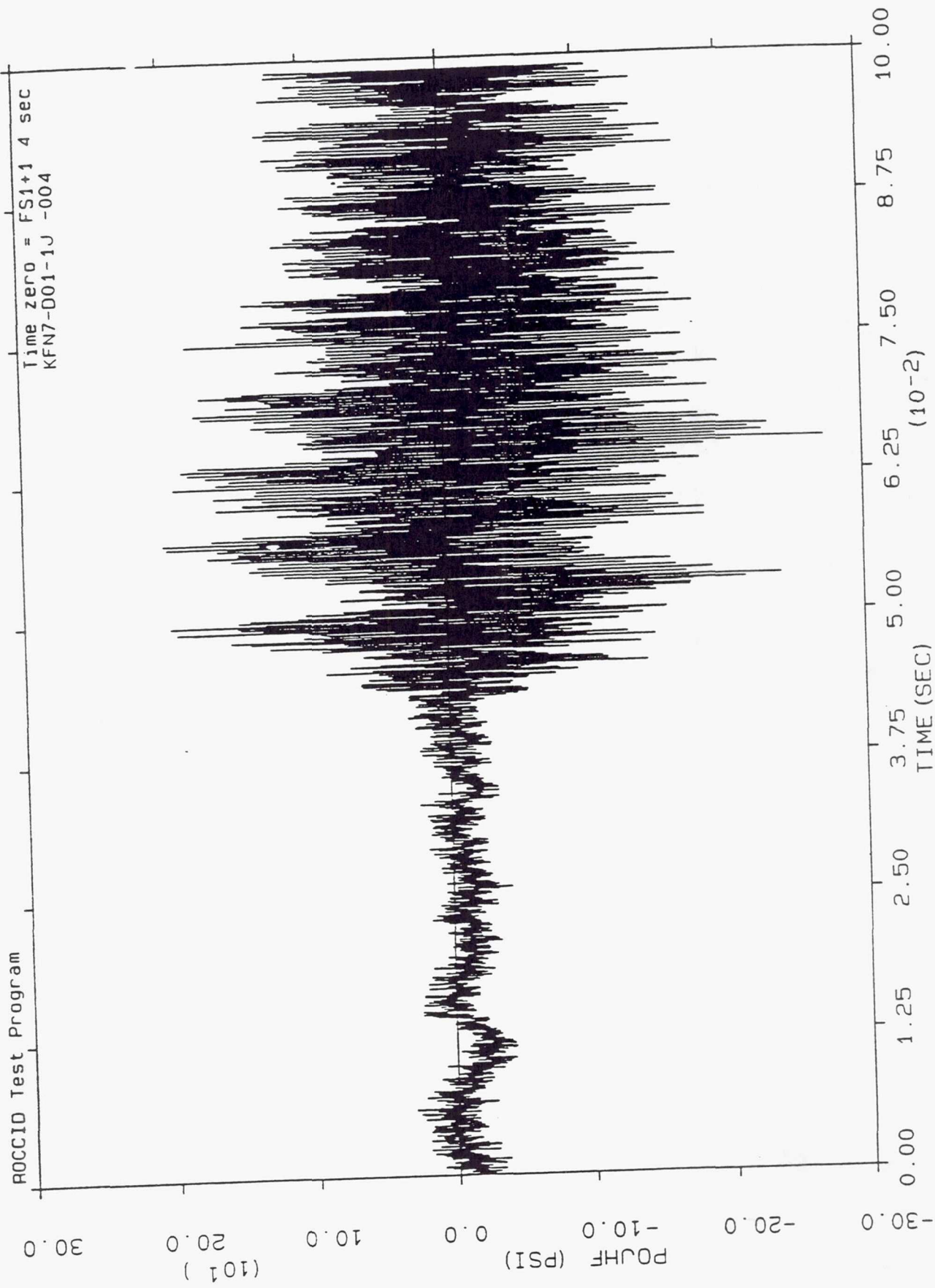
Time zero = FS1+1.4 sec
KFN7-D01-1J -004



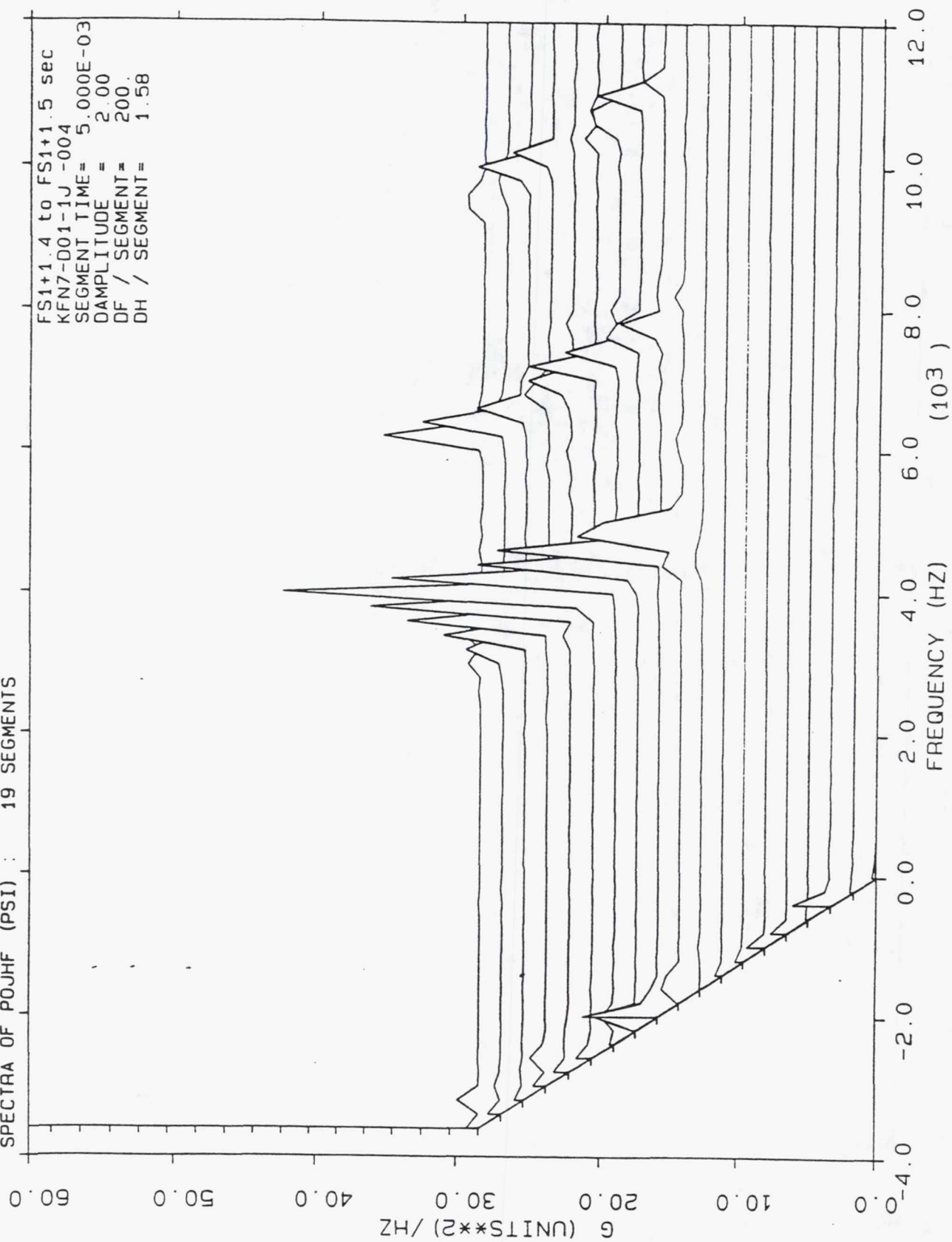
SPECTRA OF PCHF5 (PSI) 19 SEGMENTS

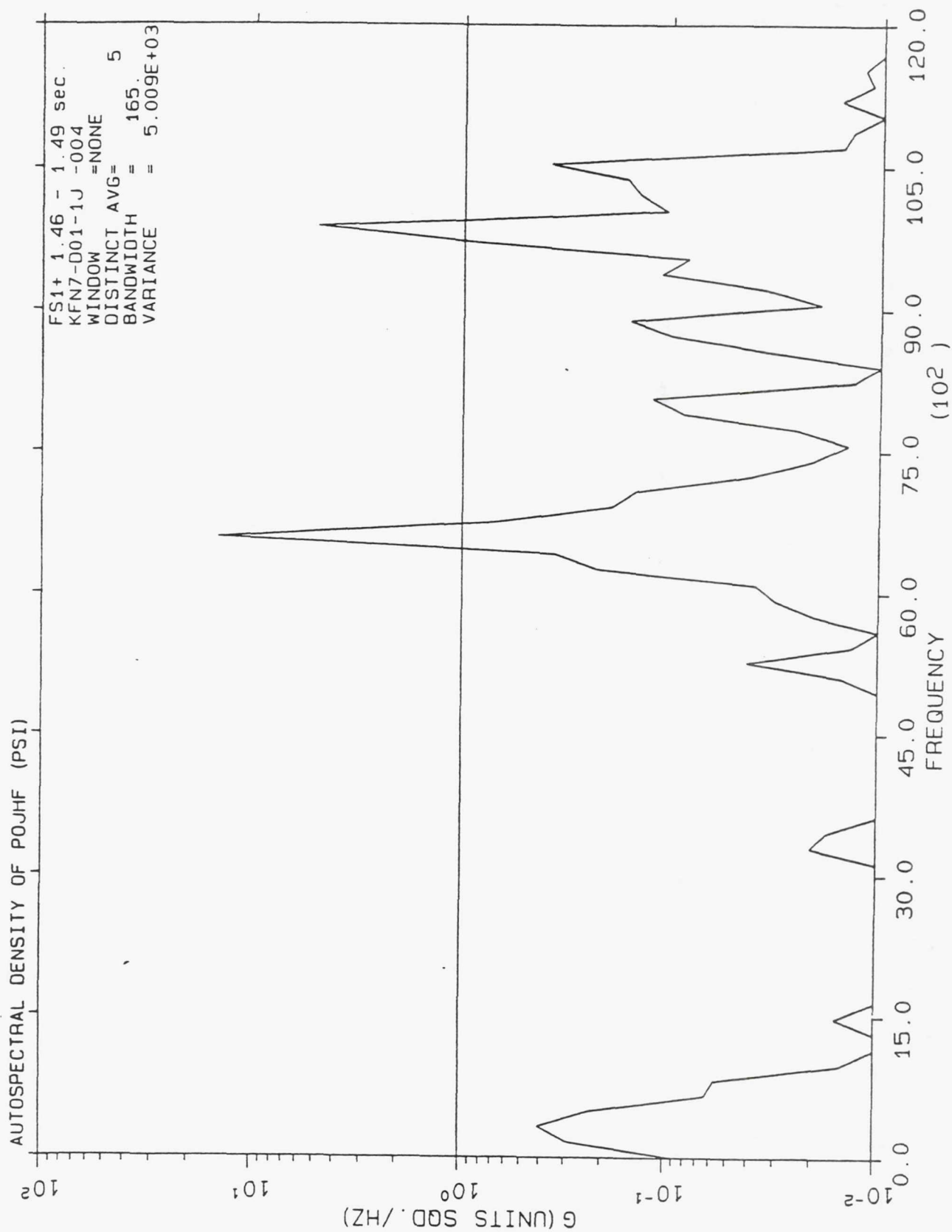






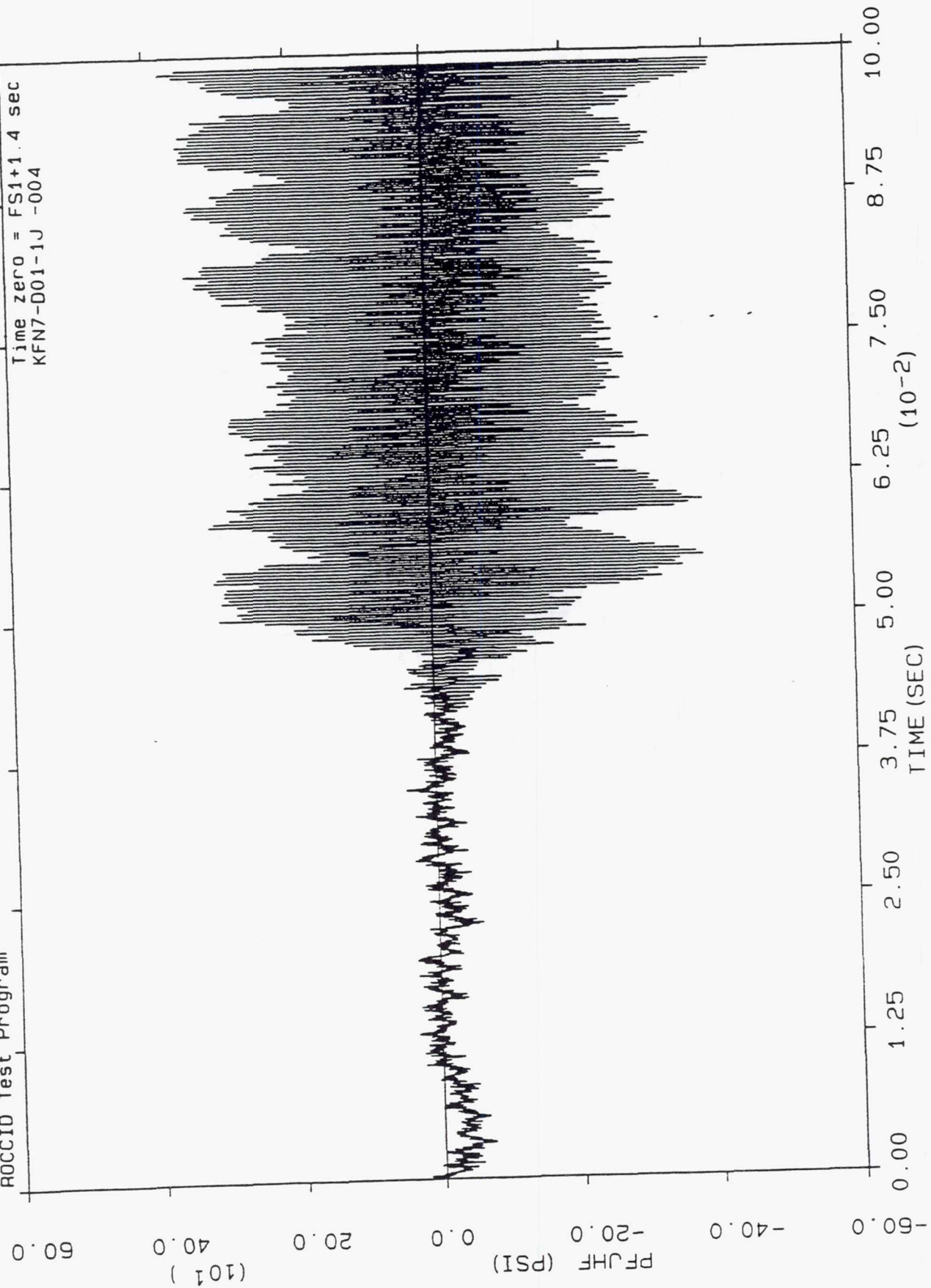
SPECTRA OF POJHF (PSI) : 19 SEGMENTS



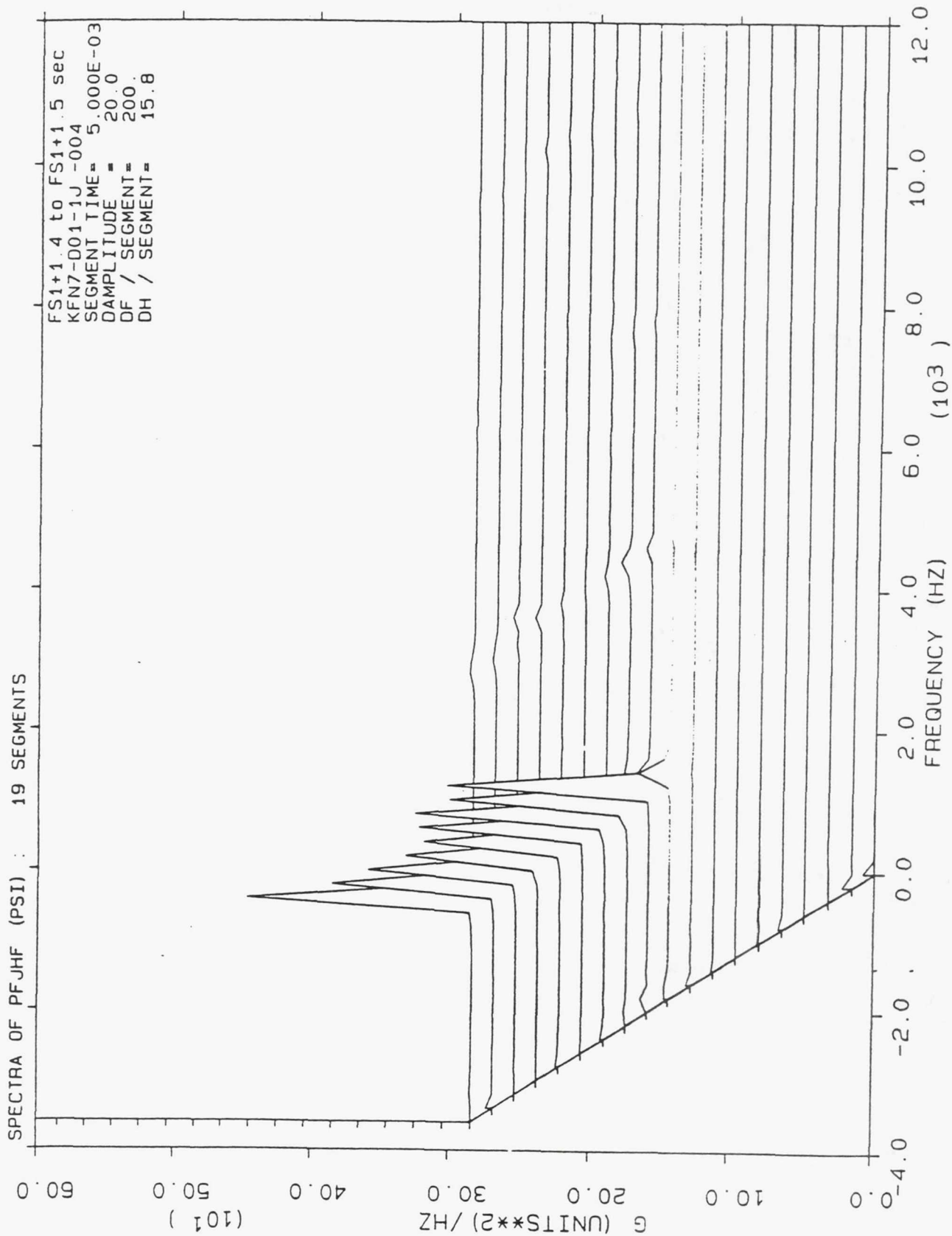


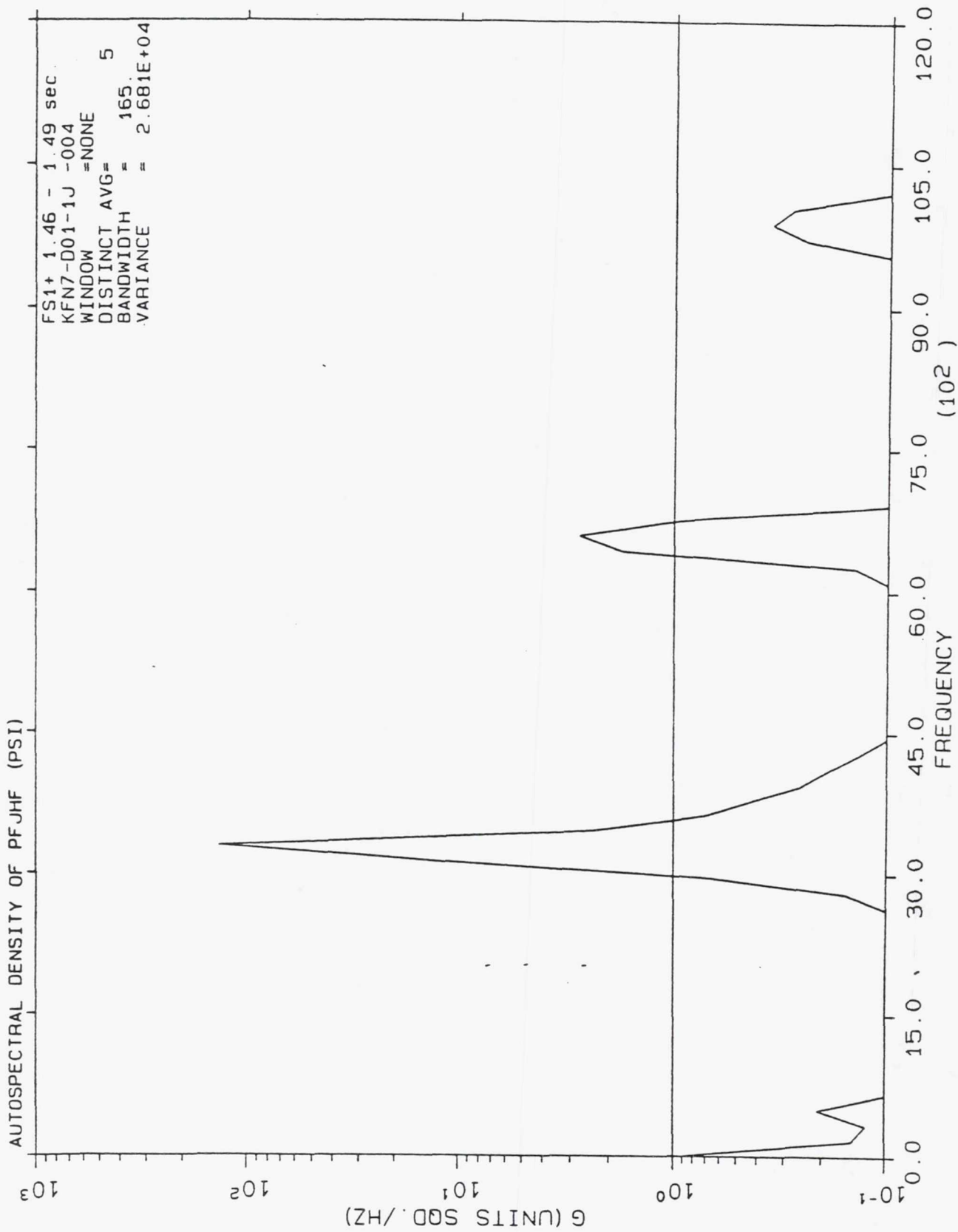
ROCCID Test Program

Time zero = FS1+1.4 sec
KFN7-D01-1J -004



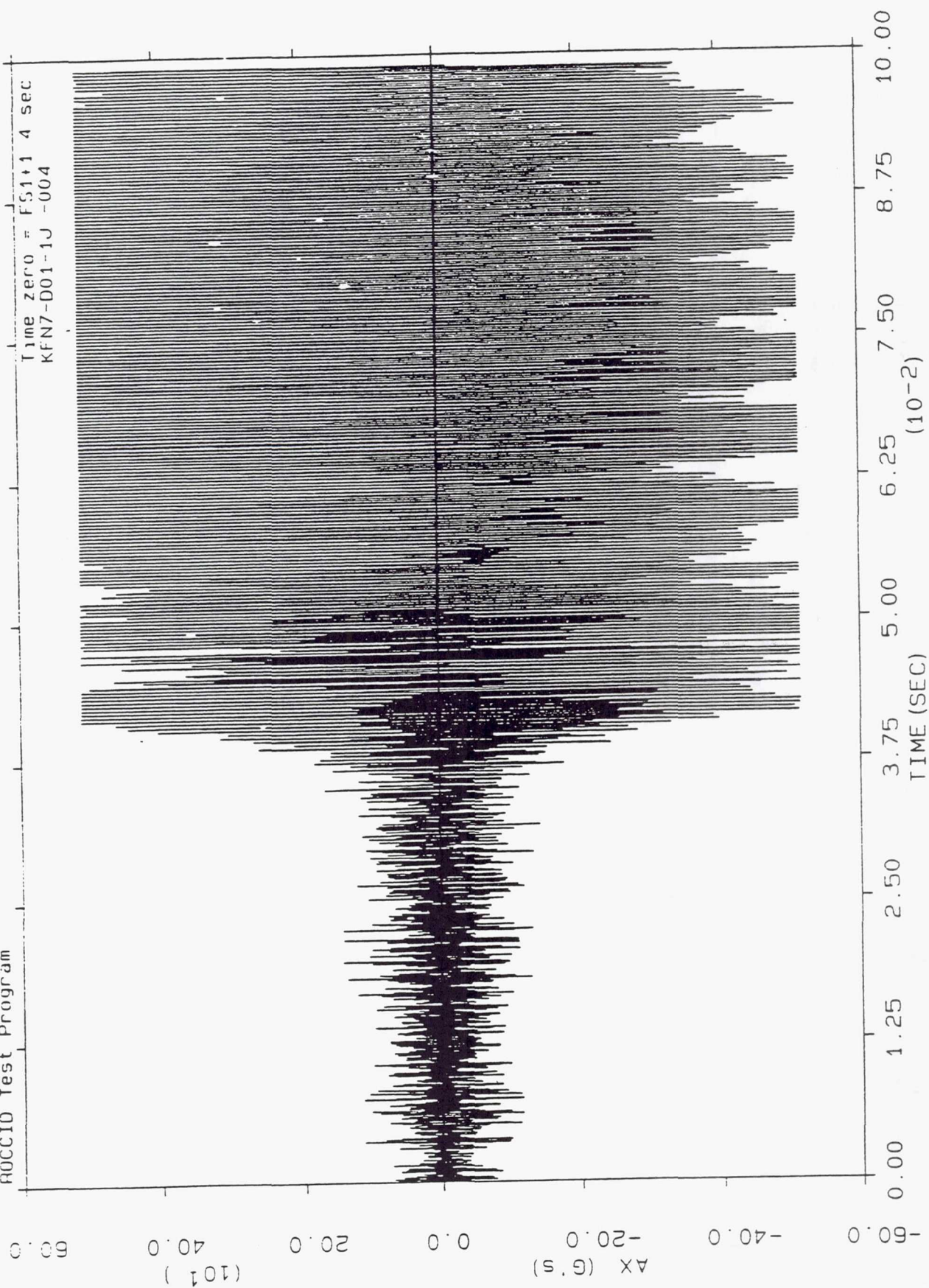
SPECTRA OF PFJHF (PSI) : 19 SEGMENTS

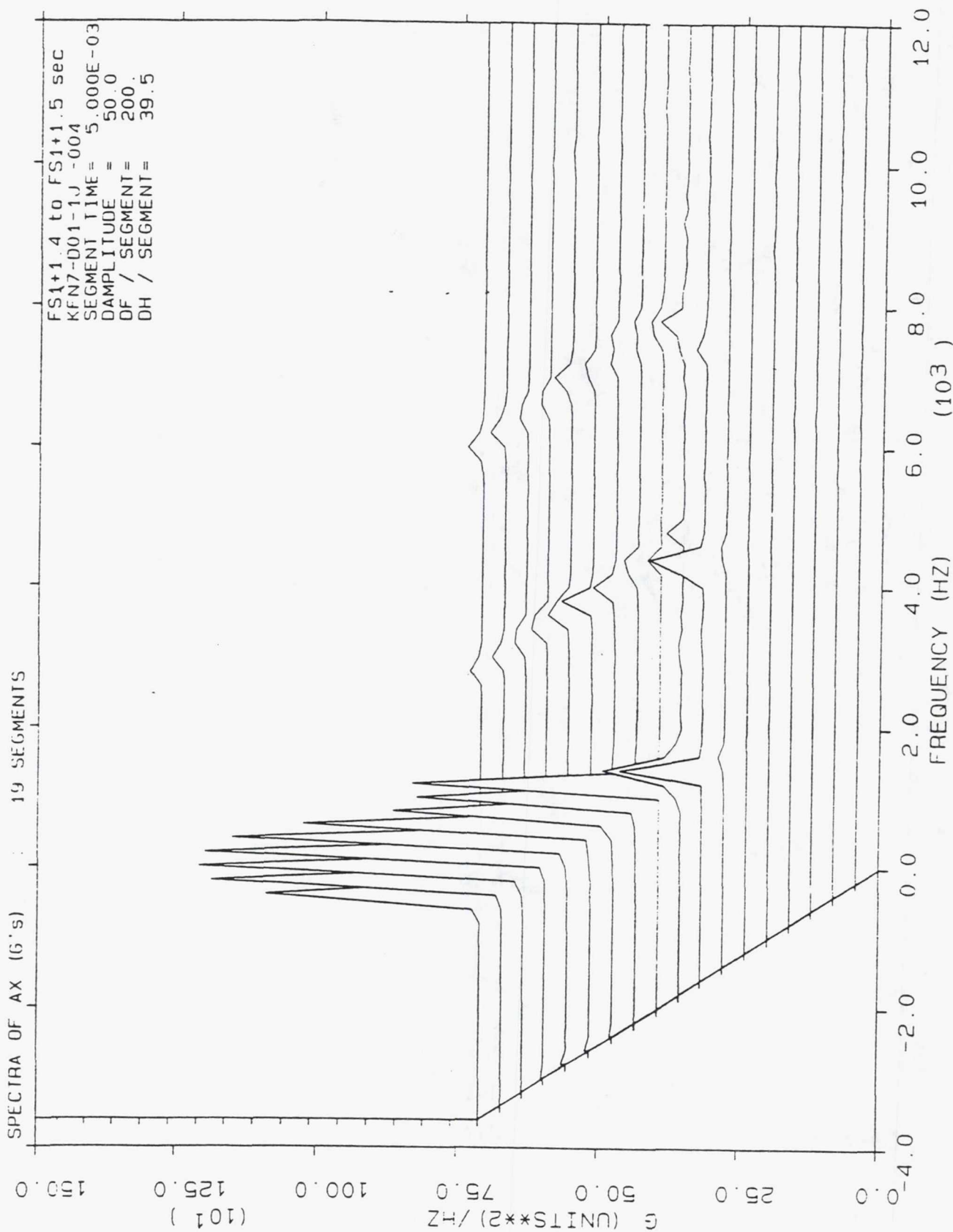


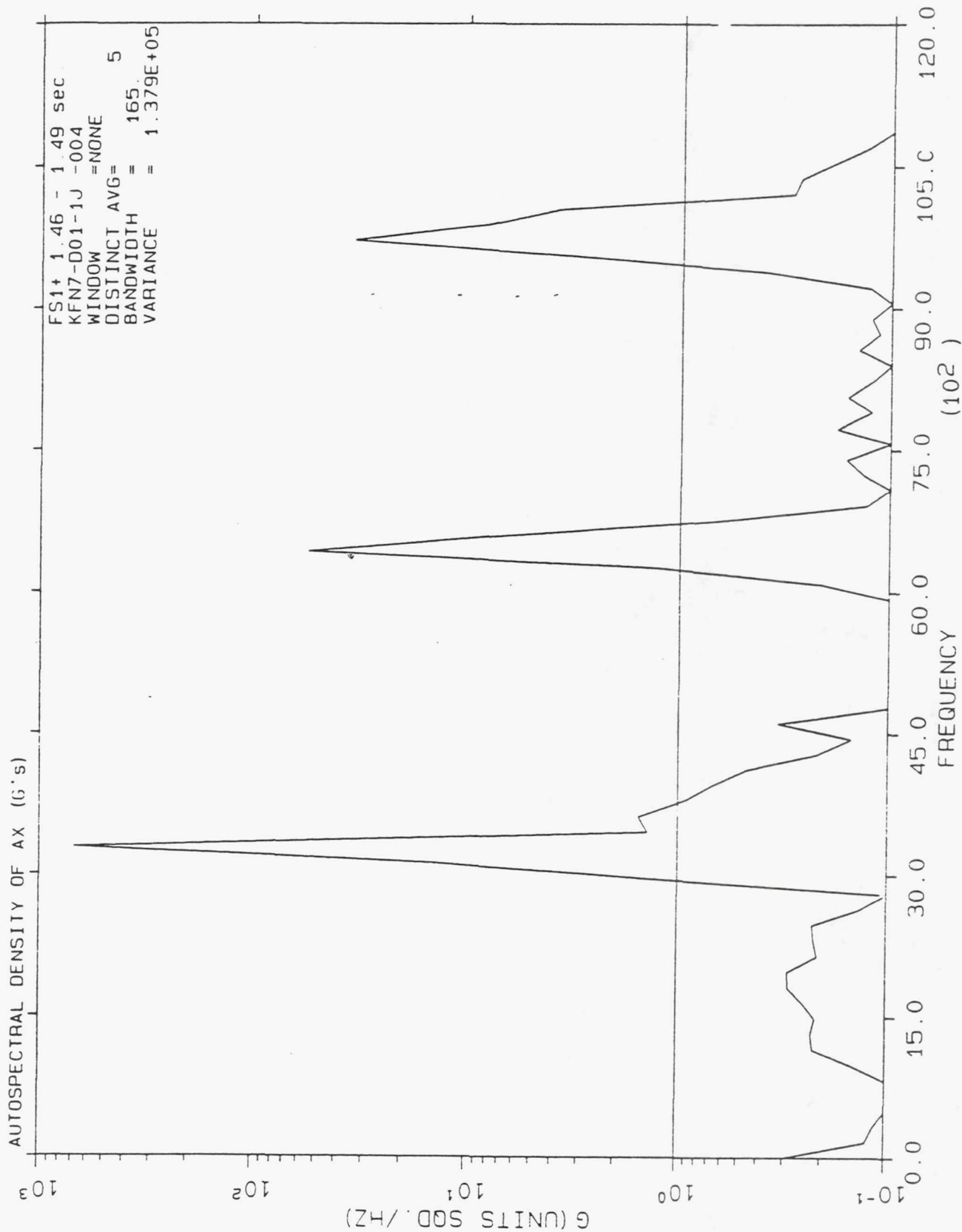


ROCCIO Test Program

Time zero = F51+1 4 sec
KFN7-D01-1J -004

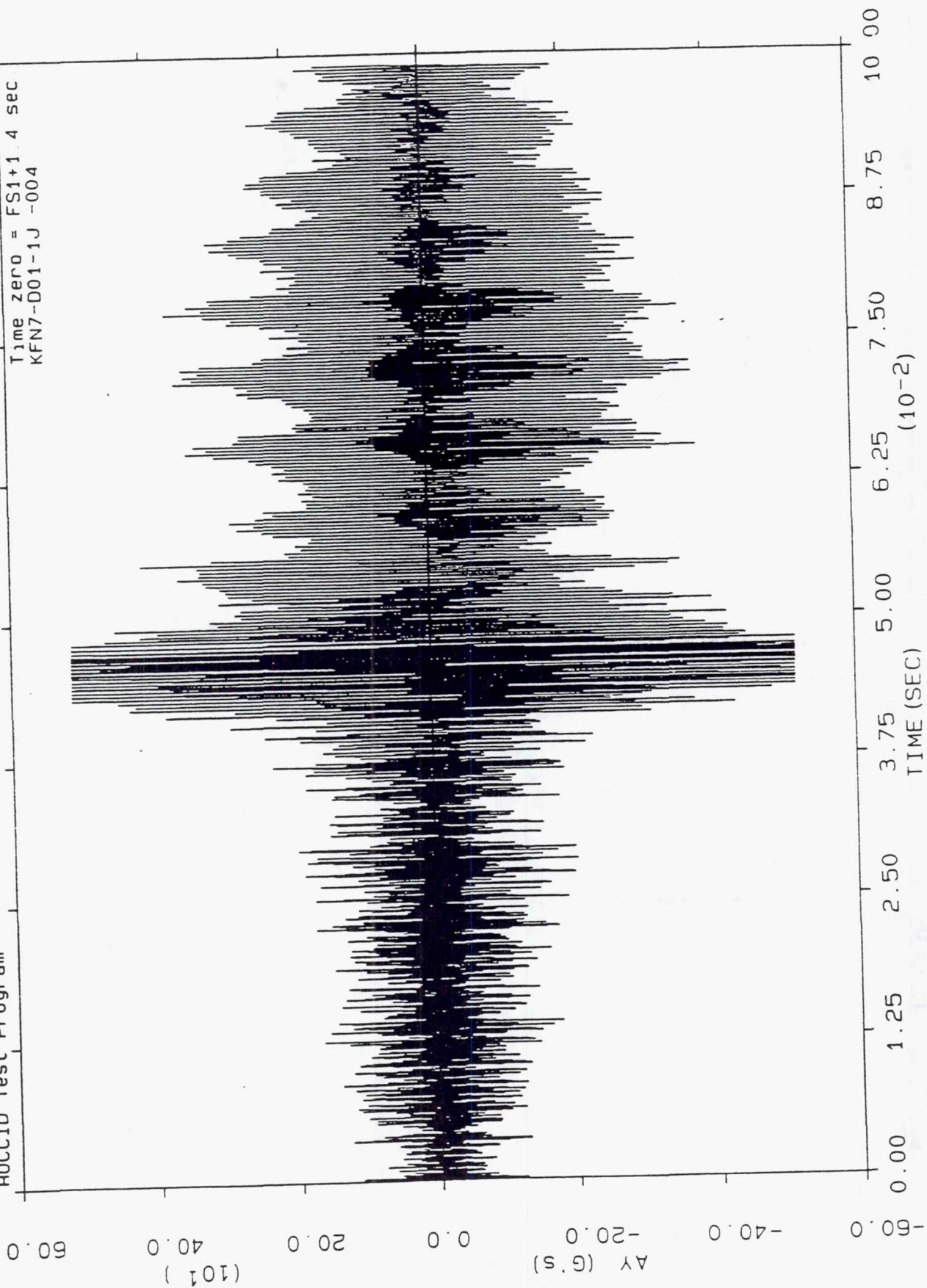


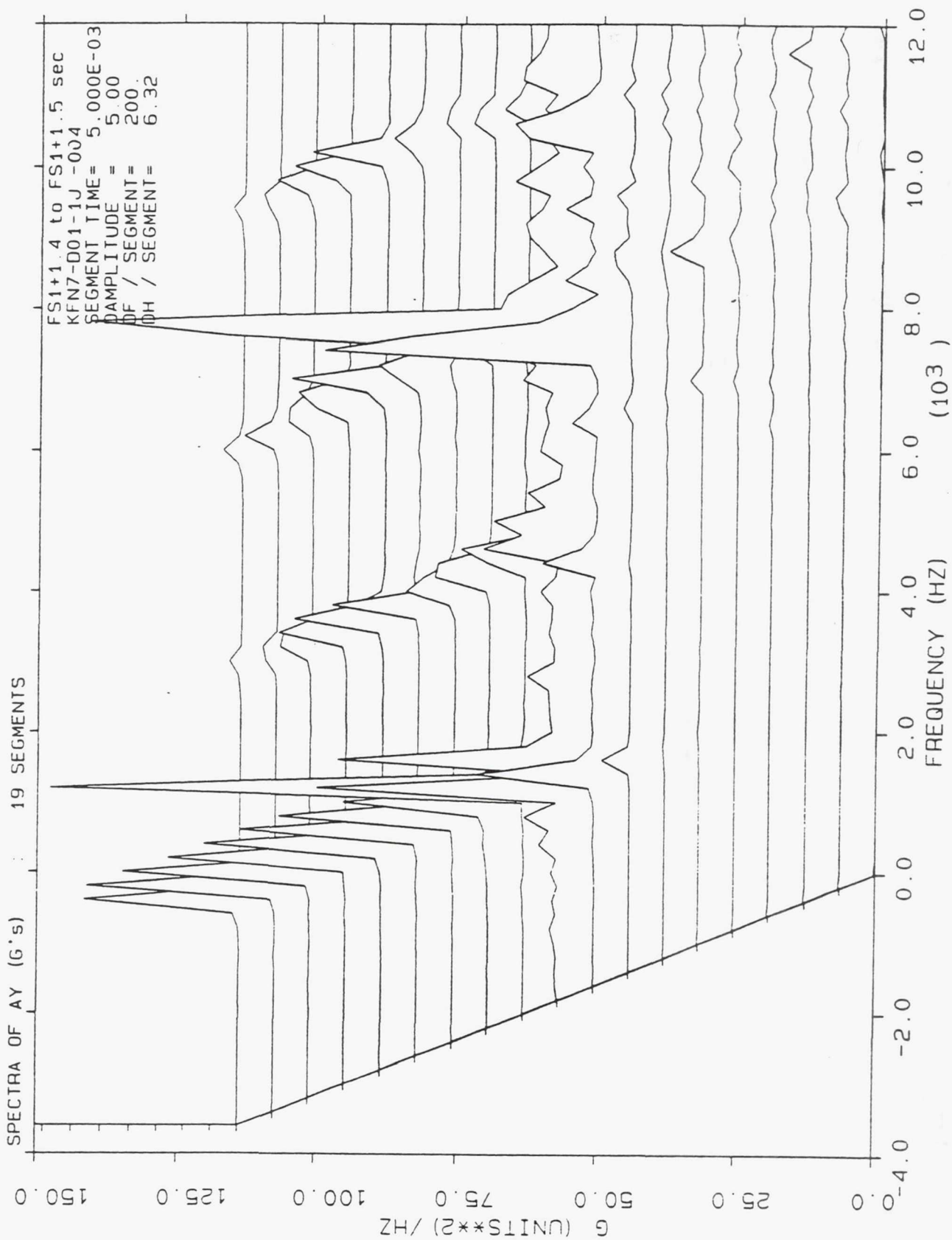


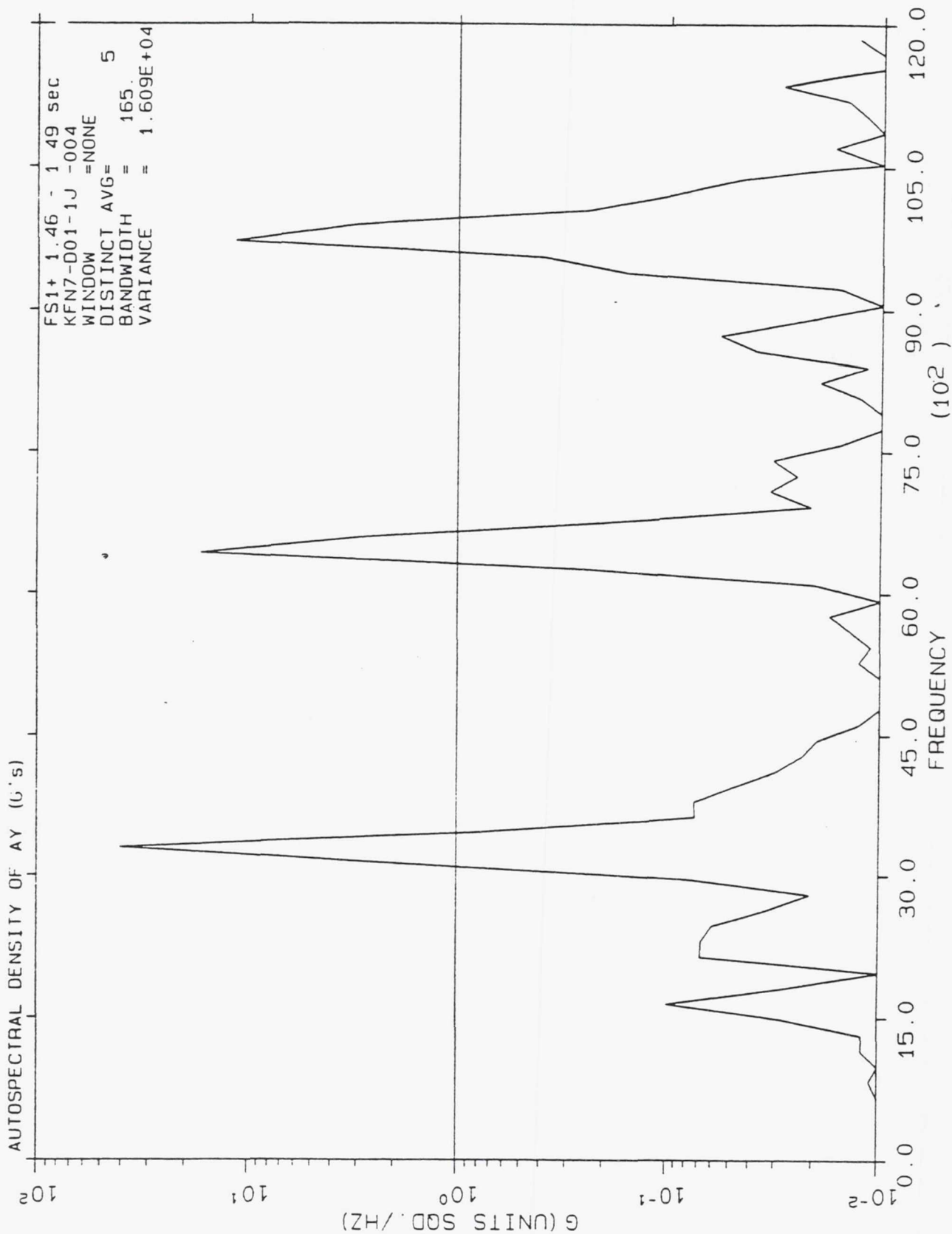


ROCCID Test Program

Time zero = FS1+1.4 sec
KFN7-D01-1J -004

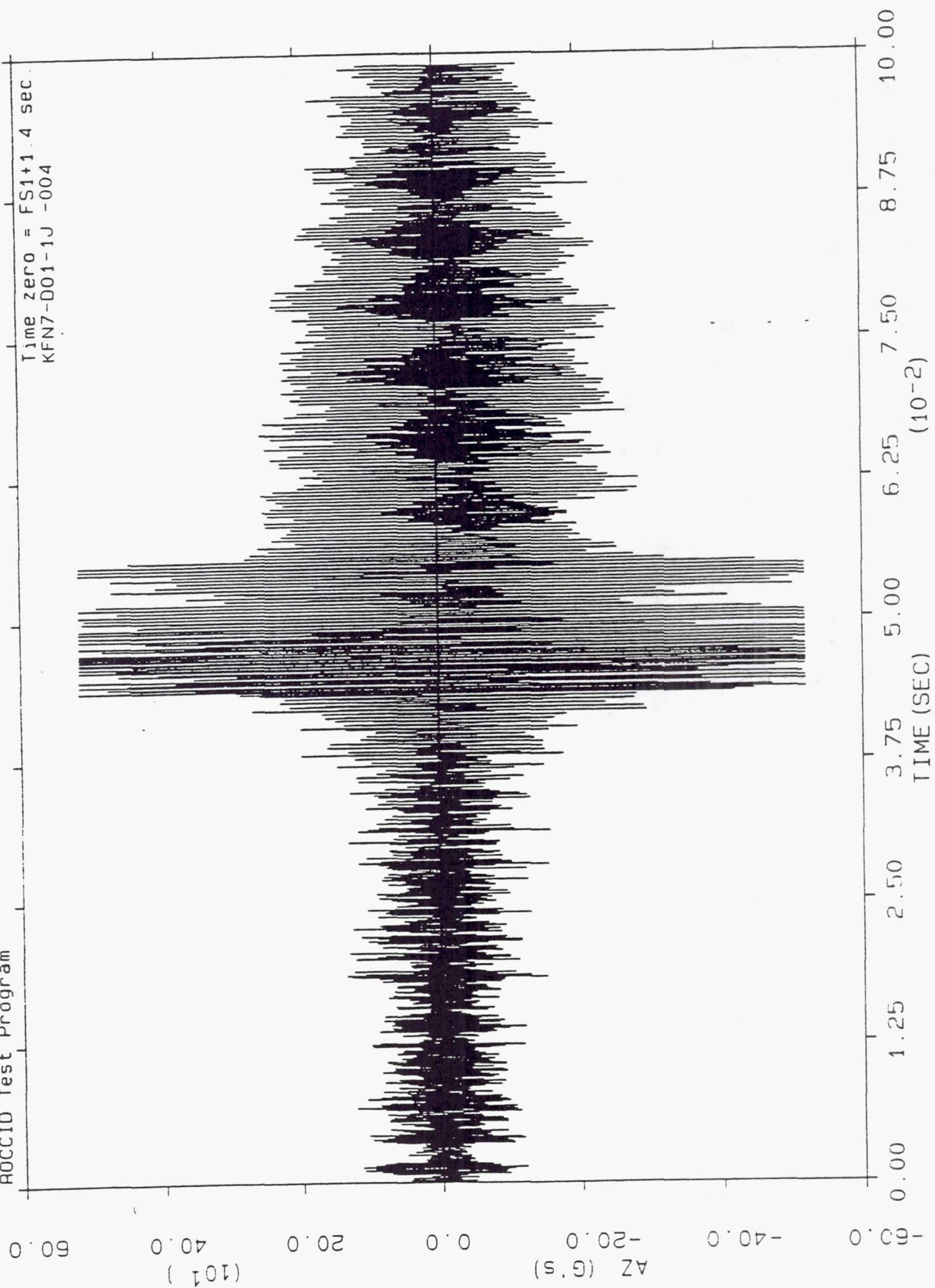






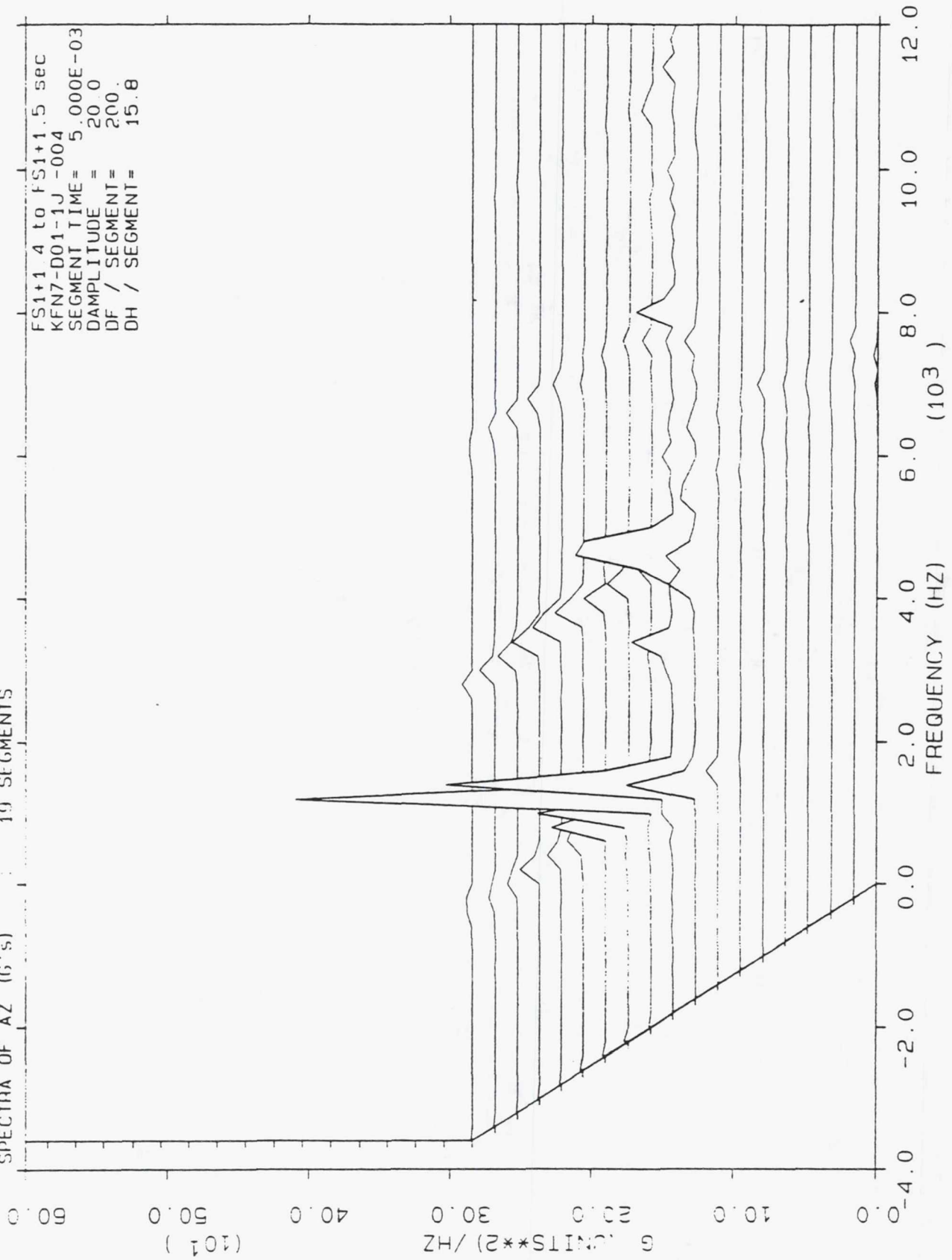
ROCCID Test Program

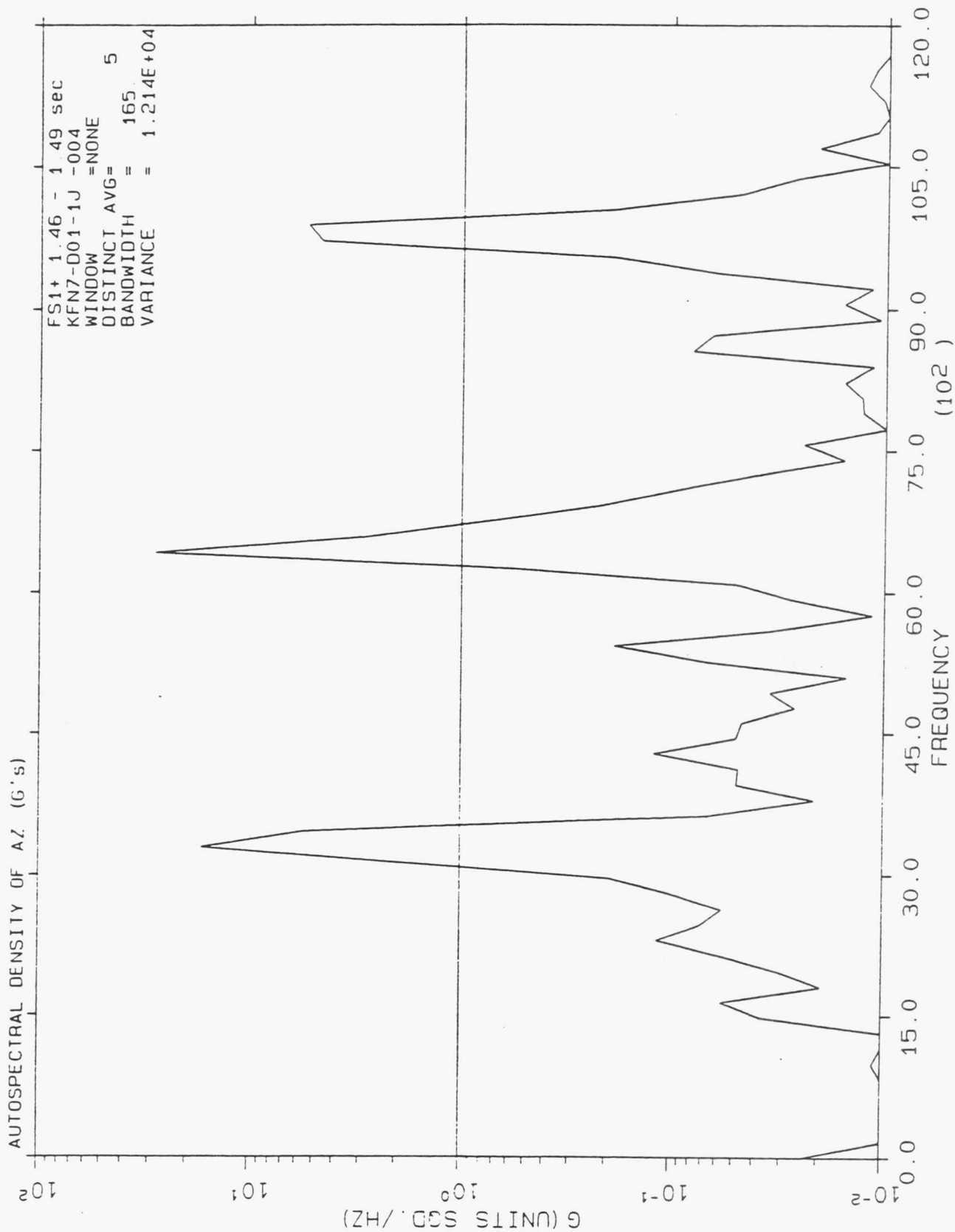
Time zero = FS1+1.4 sec
KFN7-D01-1J -004



SPECTRA OF AZ (G's) : 19 SEGMENTS

FS1+1 4 to FS1+1.5 sec
 KFN7-D01-1J -004
 SEGMENT TIME= 5.000E-03
 DAMPLITUDE = 20.0
 DF / SEGMENT= 200.
 DH / SEGMENT= 15.8





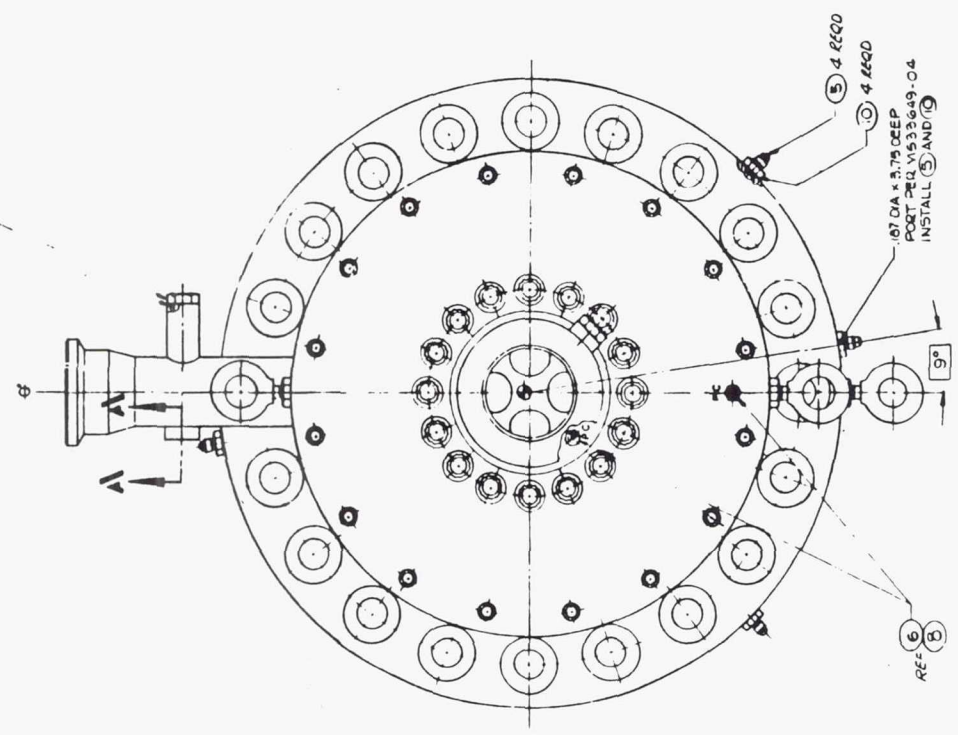
APPENDIX D

ROCCID VALIDATION HARDWARE
DESIGN DRAWING PACKAGE

LIST OF DRAWINGS

<u>Drawing Description</u>	<u>Drawing No.</u>	<u>No. of Sheets</u>	<u>Figure Nos.</u>
Engine assembly	1206430	2	D-3/D-4
Injector Assembly	1206427	1	D-5
Injector Flange	1200773A	3	D-6/D-8
Injector Core Assembly	1206423	2	D-9/D-10
Injector Core	1200729	7	D-11/D-17
Thrust Chamber Assembly	1206428	3	D-18/D-20
Chamber Body Forging	1206432	1	D-21
Chamber Liner	1206429	1	D-22
Chamber Retaining Plate	1200976A	1 + ADCN	D-23/D-24
Chamber Proof Plate	1200977A	1 + ADCN	D-25/D-26
1/4 Wave Tube Resonator	1206426	1	D-27
Resonator Cavity Blank	1206431	1	D-28
Bomb Adapters	1201080A	1	D-29

- NOTES:
1. INTERPRET DRAWING PER ATC-STD-4028.
 2. LOX CIRCUIT CLEANLINESS PER INFC-SPEC-164; ISA IS 2.75 SQ FT. FUEL CIRCUIT PER ATC-STD-4940, LEVEL 1000. CORO ISA IS 3.0 SQ FT. AND FLAME ISA IS 3.2 SQ FT.
 3. MAKE PER ASSTP-7A WITH 1206427, APPLICABLE DASH NUMBER AND AERJCT TESTSTIONS ASSIGNED SERIAL NUMBER.
 4. ASSEMBLED WEIGHT IS 600 LB.
 5. PROTECTIVE CLOSURES REQUIRED.
 6. APPLY ITEM 25 TO ALL THREADS PRIOR TO INSTALLATION.
 7. APPLY ITEM 21 TO ALL O-RINGS PRIOR TO INSTALLATION.
 8. STORAGE AND USE CONTROL PER ATC-STD-401 AND ATC-STD-402.



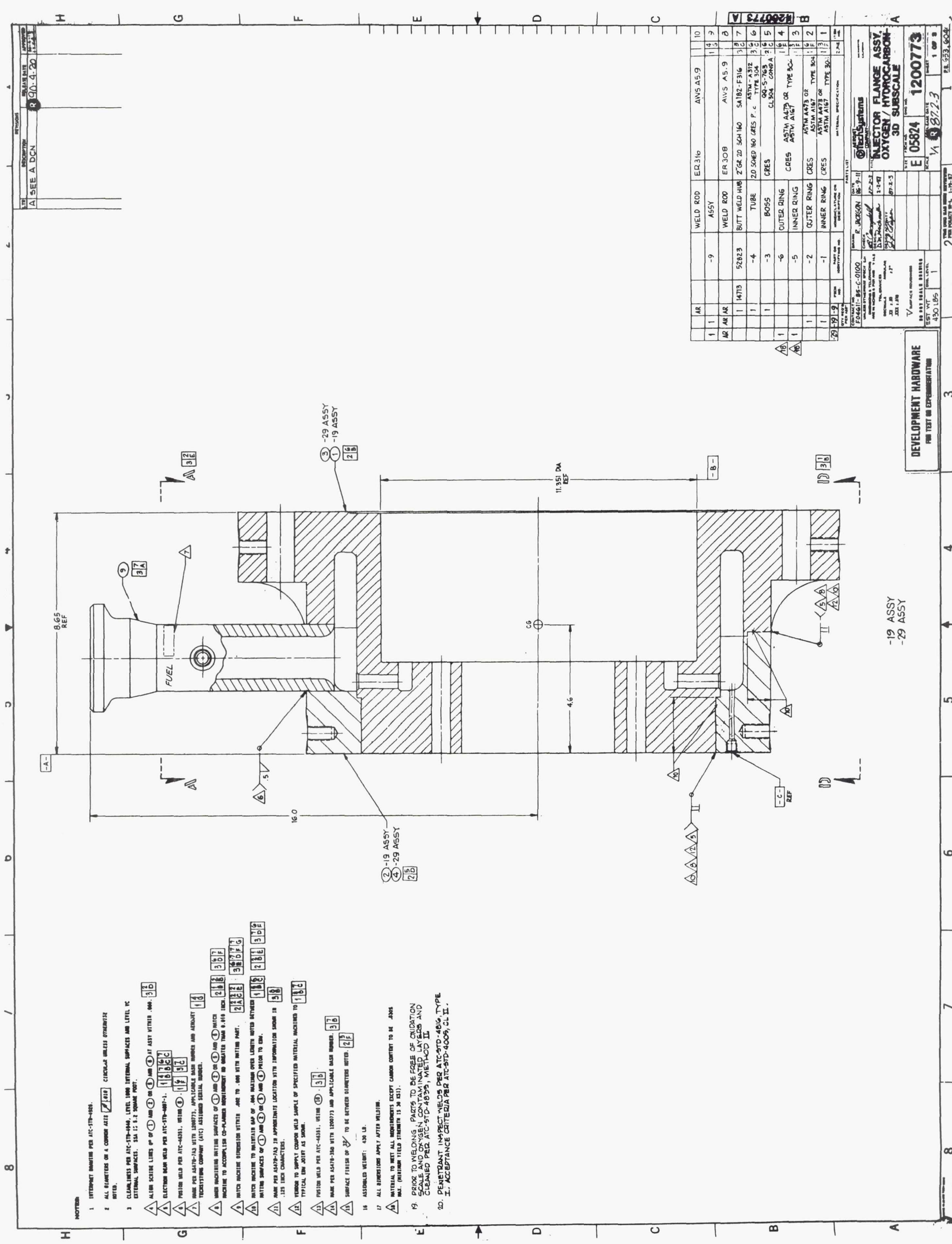


Figure D-4 D-6

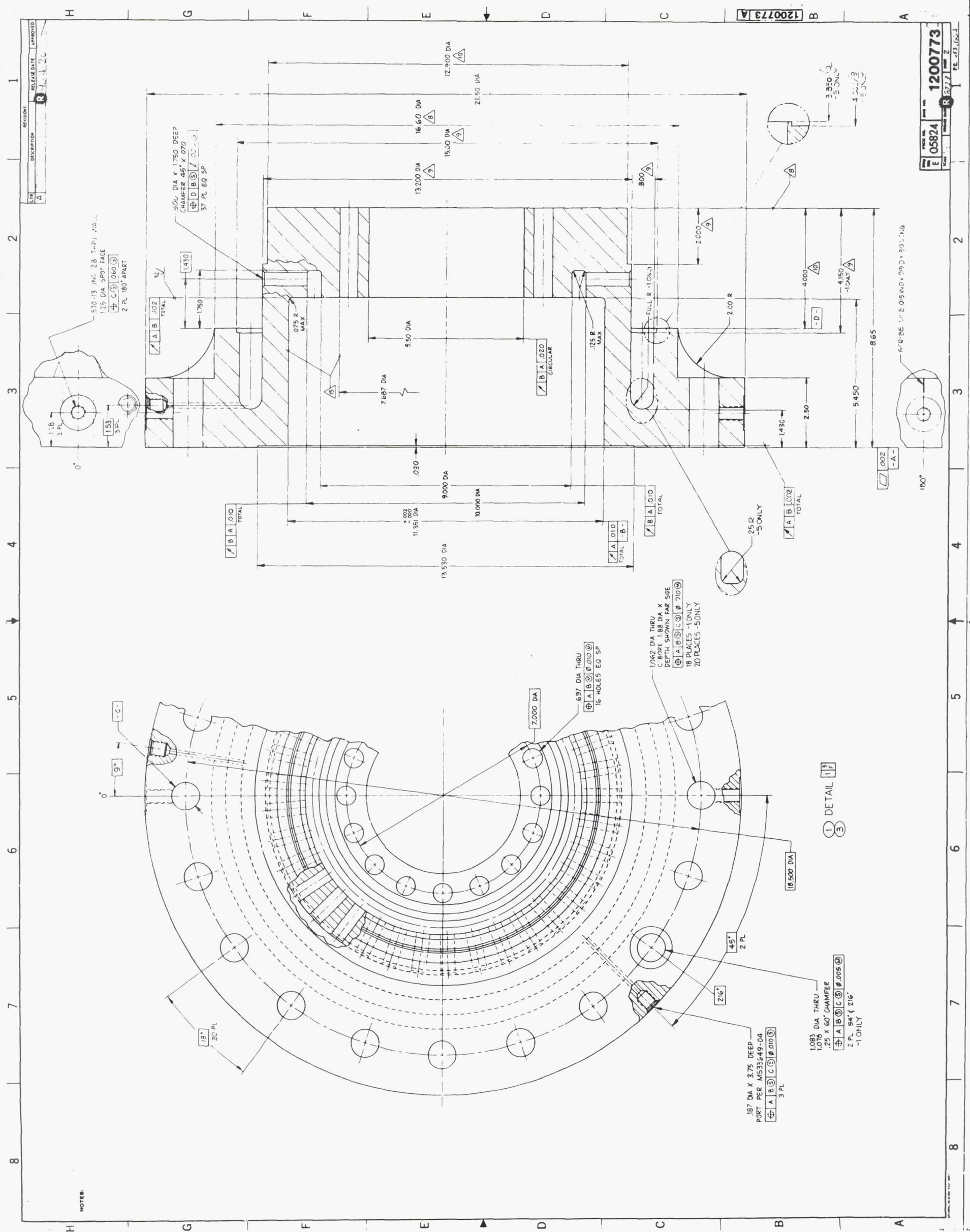


Figure D-5 D-7

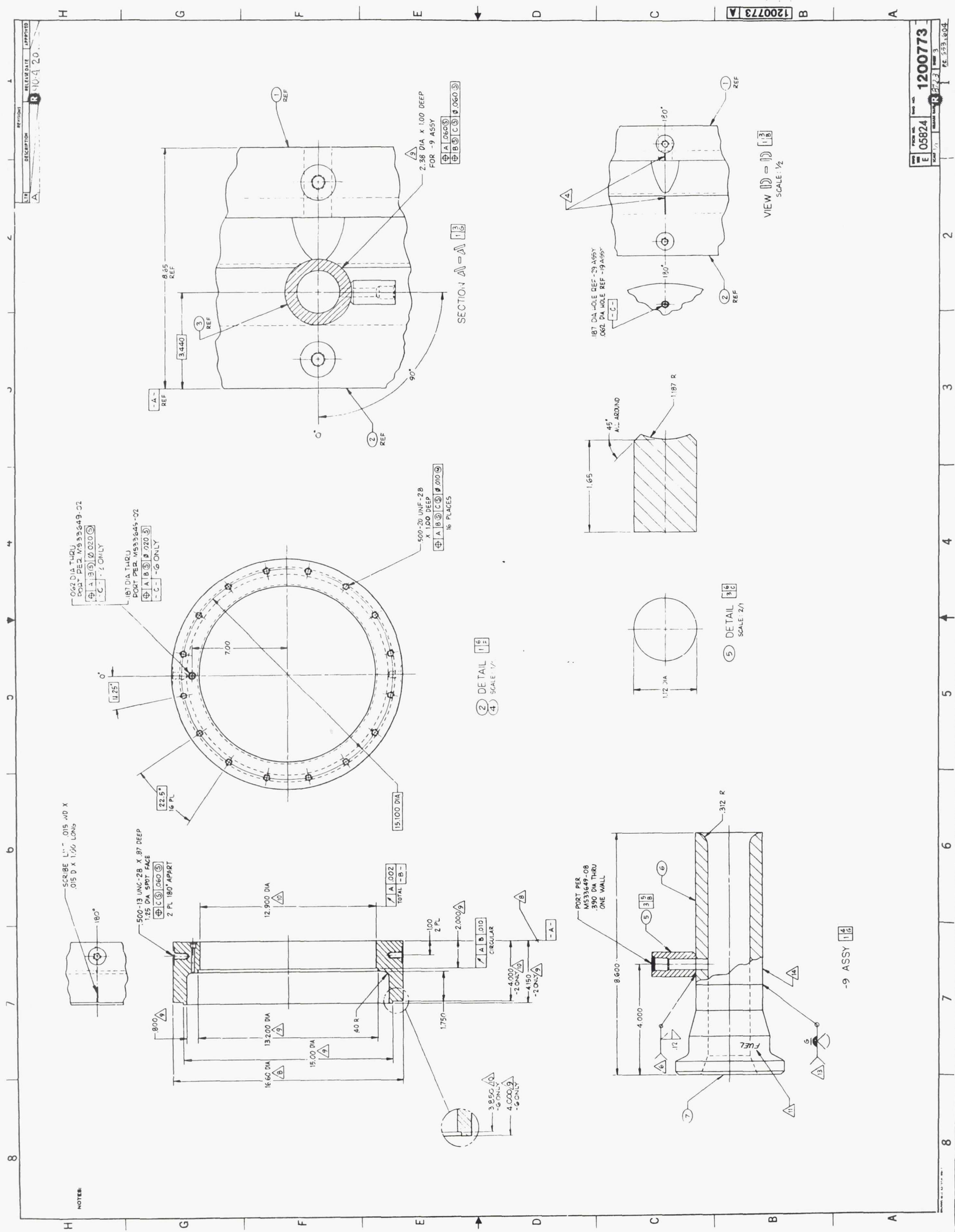


Figure D-6 D-8

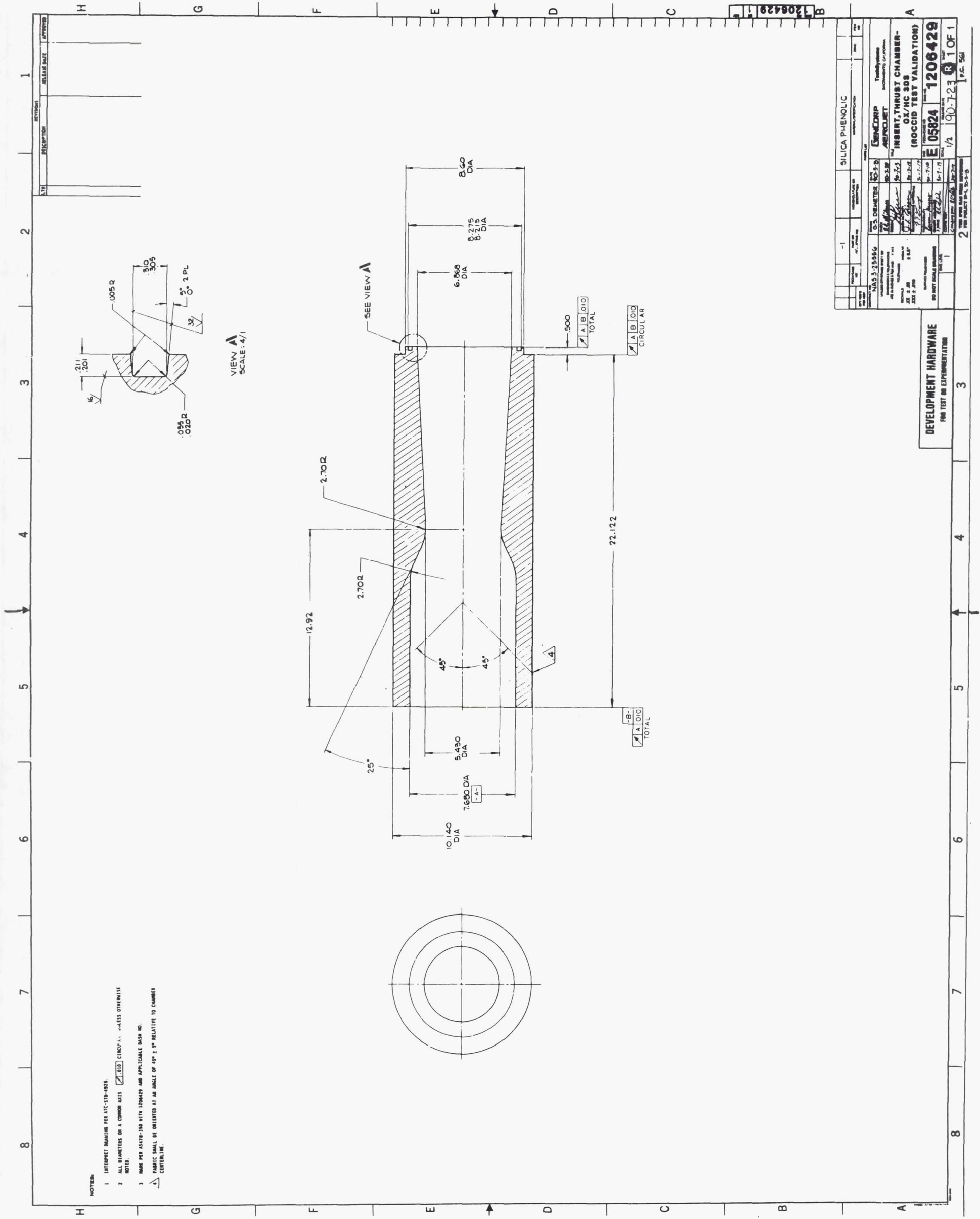


Figure D-7

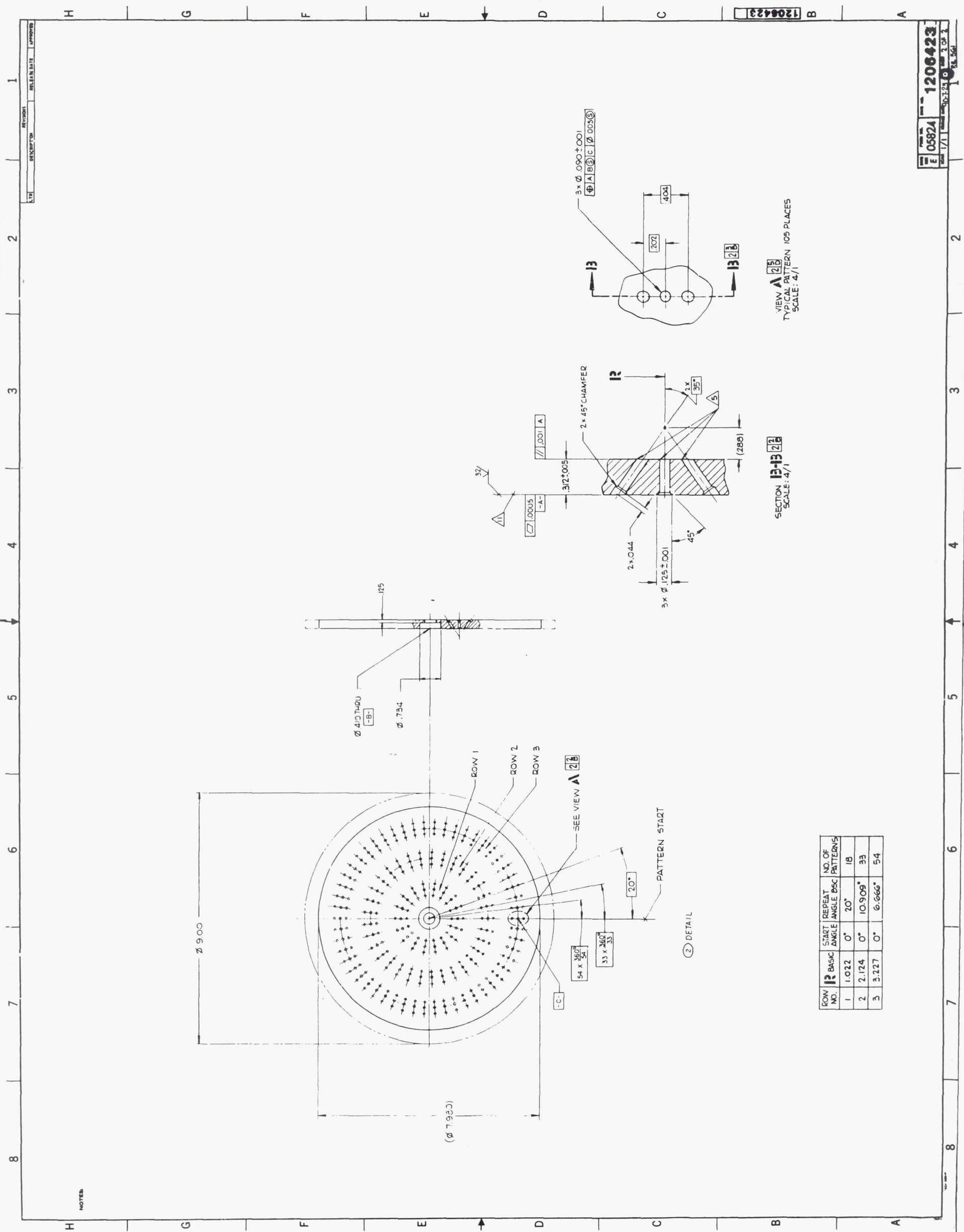


Figure D-8 D-10

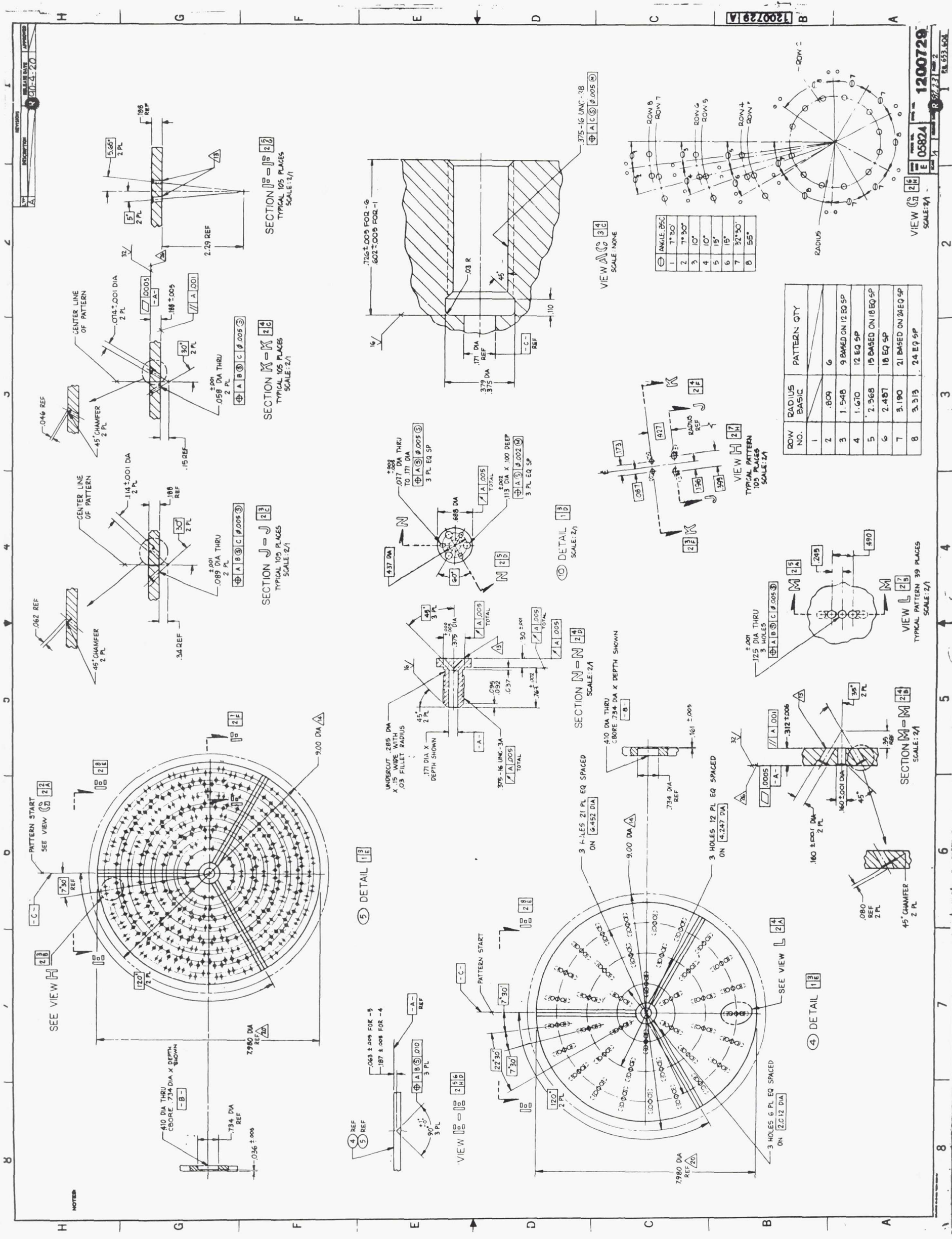


Figure D-10



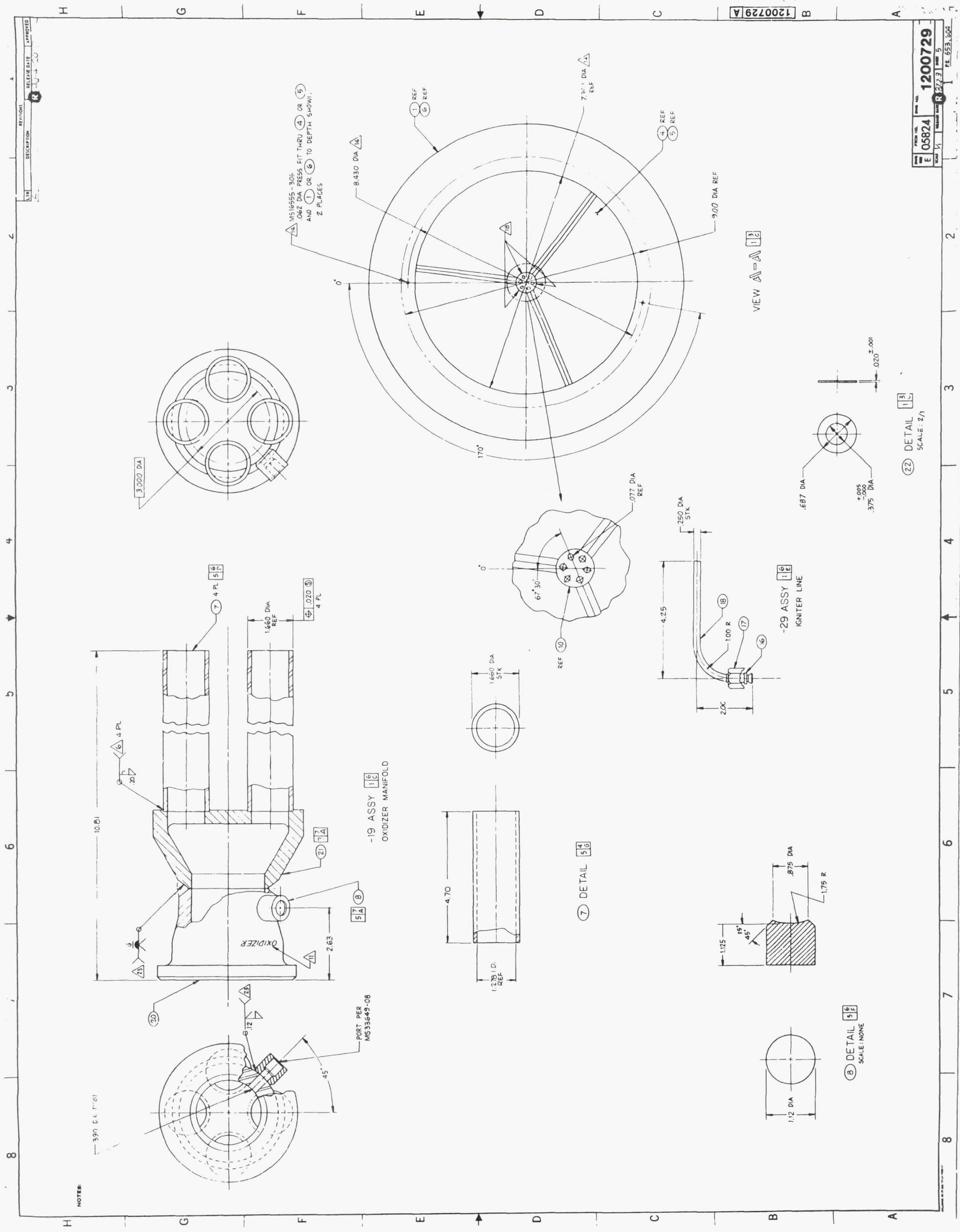


Figure D-13 D-15

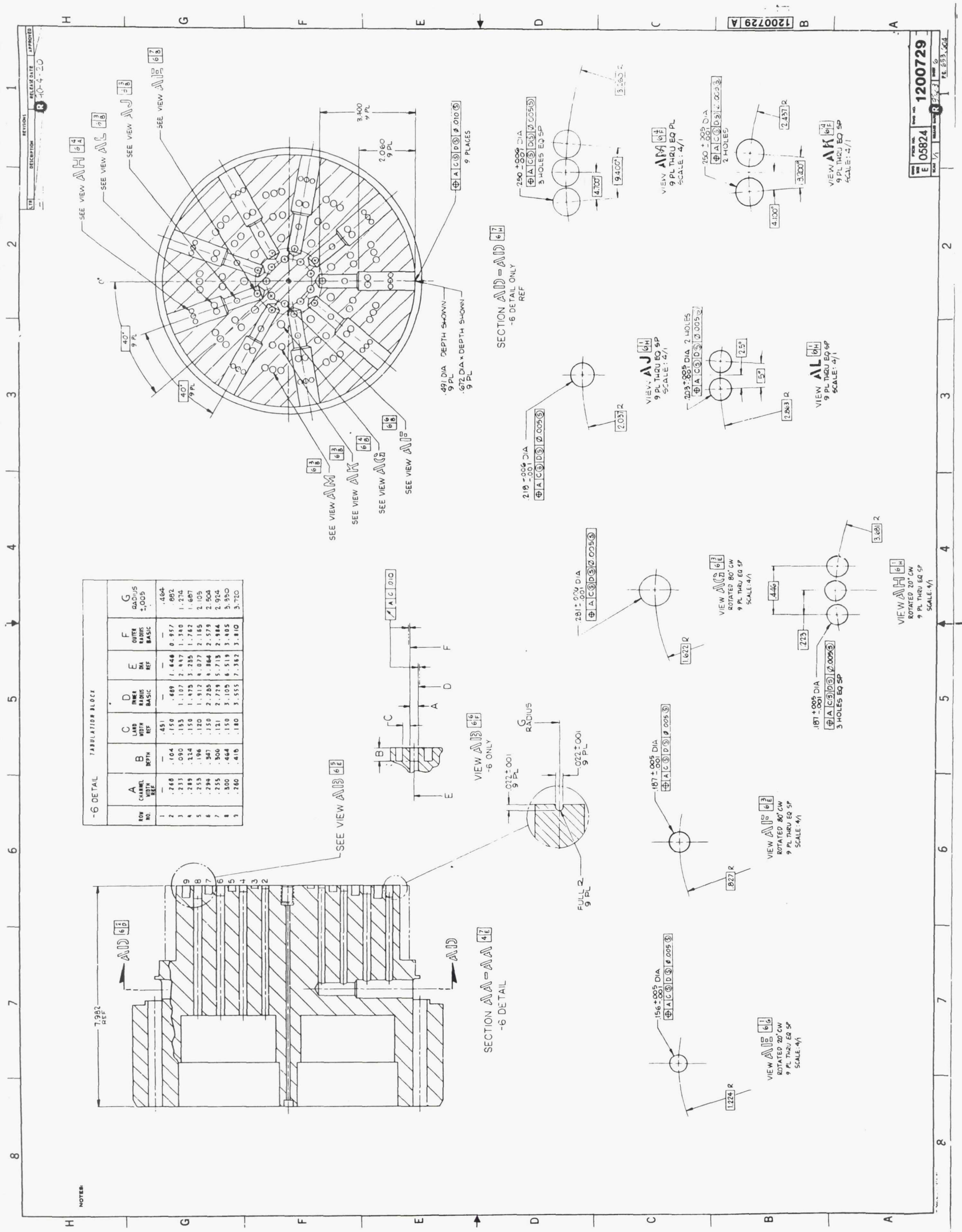
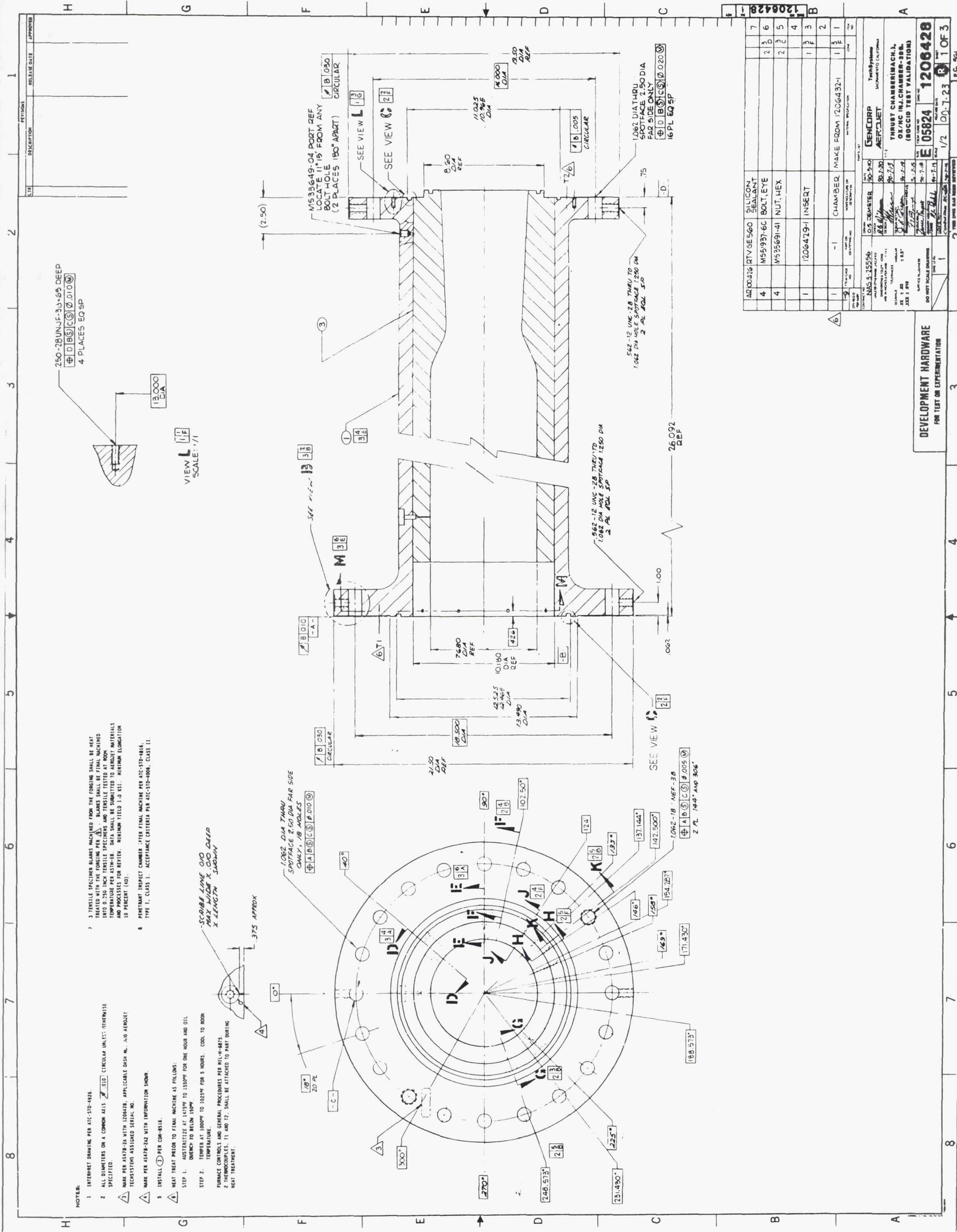


Figure D-14 D-16



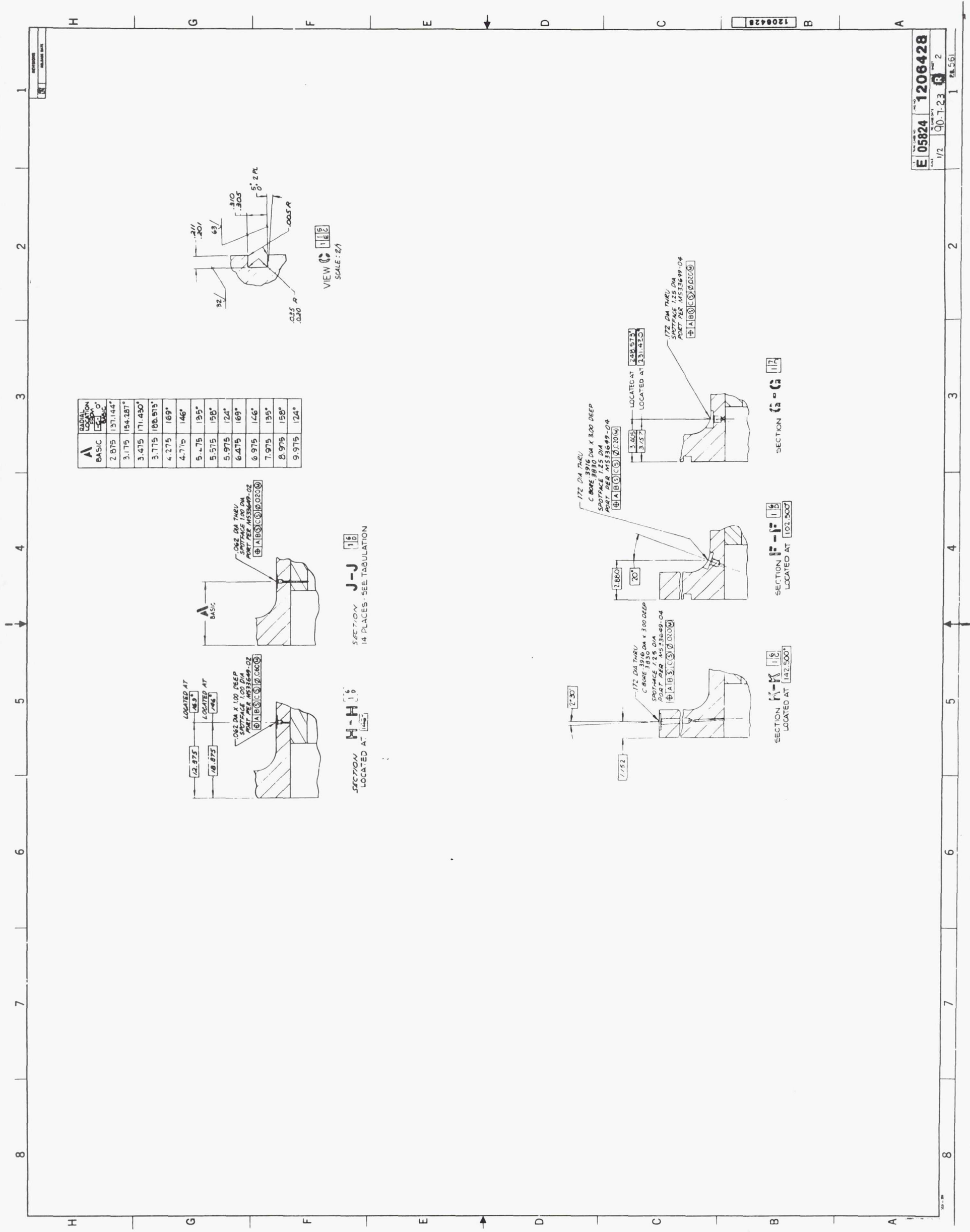
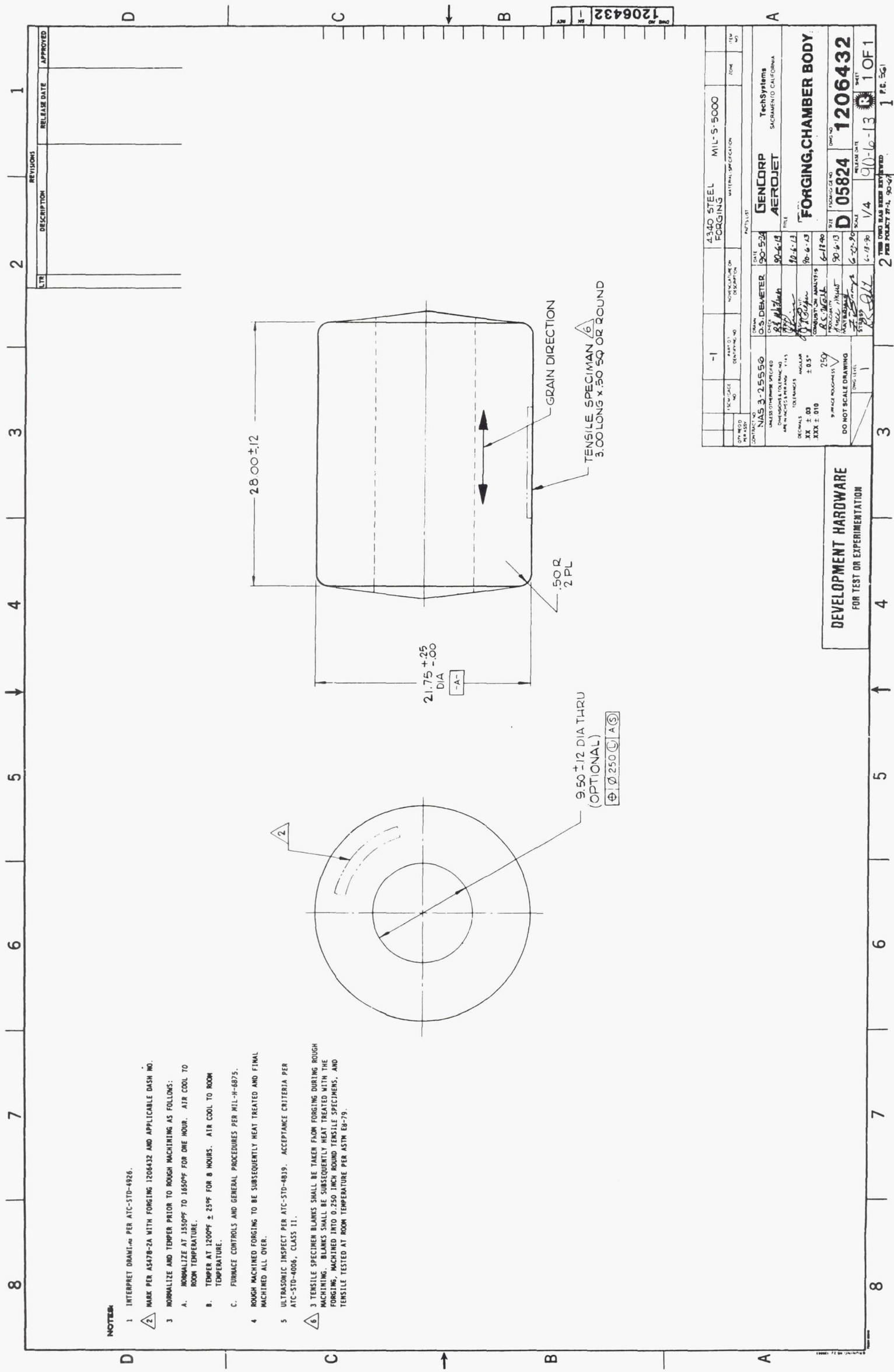


Figure D-17 D-19



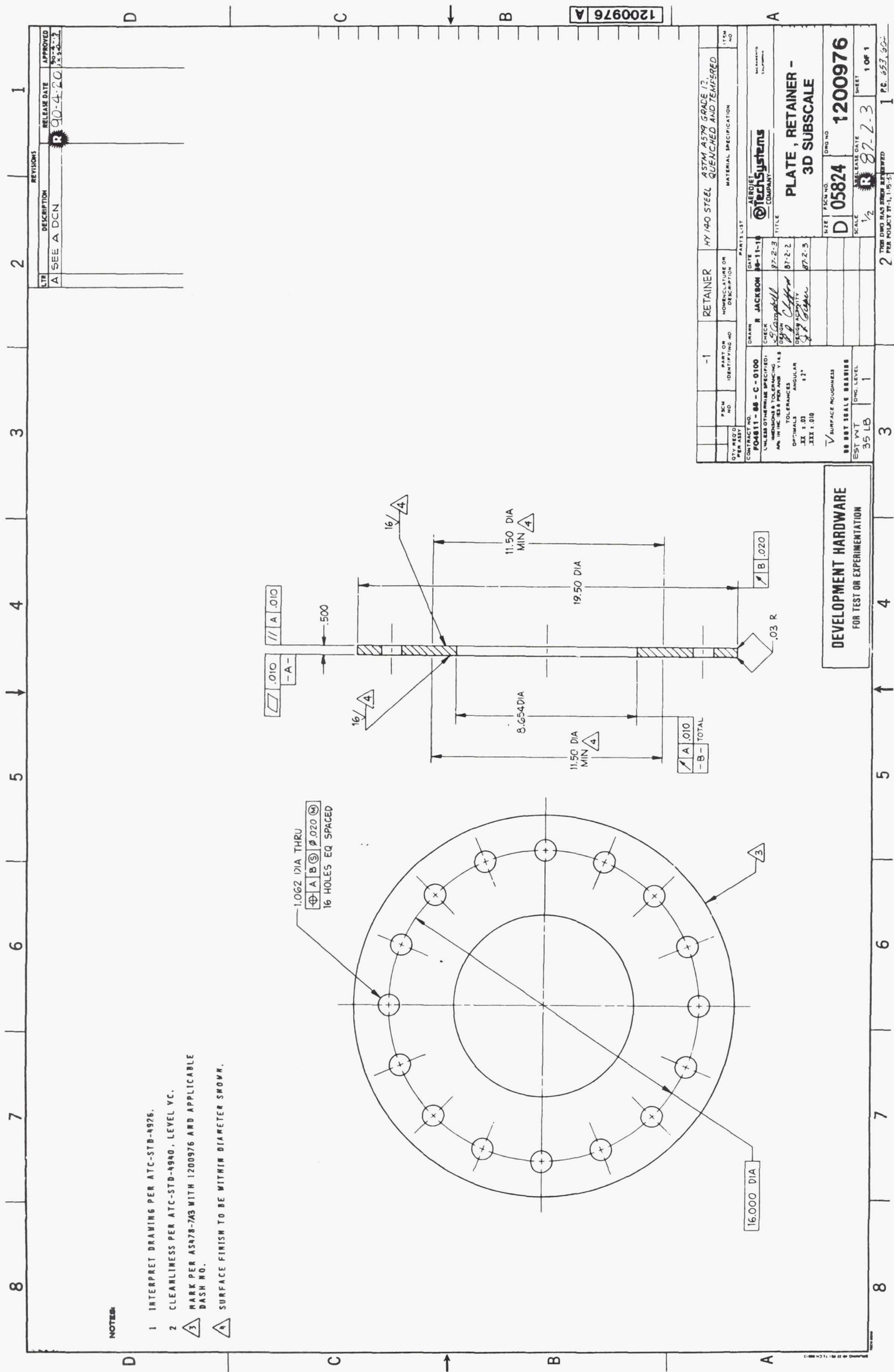
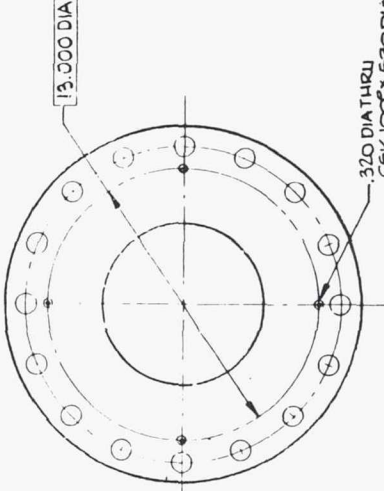


Figure D-21

<input checked="" type="checkbox"/> ADEN		<input type="checkbox"/> DCN	DATE 90-5-15	DOCUMENT CHANGE NOTICE		DOCUMENT NUMBER 1200976	SHEET A-1
TECHNOLOGY		RELEASE DATE 90-7-23		TECHSYSTEMS SACRAMENTO, CALIFORNIA		DOCUMENT TITLE PLATE, RETAINER - 3D SUBSCALE	SHEET 1 of 1
PREPARED BY DEMETER		DESIGN 90-7-18		APPROVALS		STRESS 90-7-18	
SH		ZONE	ITEM	DESIGN 90-7-18		STRESS 90-7-18	
PL		1	ADD: 5-2 RETAINER	4340 STEEL VACUUM MELT PER AMS 3414E		WPCOMPUTER R. B. BELL 90-7-26	
F/D		2	ADD CALLOUTS & DIMENSION SHOWN				
GN		3	ADD NOTE:				
			5	HEAT TREAT PRIOR TO FINAL MACHINE PER MIL-H-6875, MINIMUM YIELD 130-140 KSI.			
							
						3.20 DIA THRU CSK 100° X 530 DIA 4 HOLES EQ SPACED	
						PC 653, 604, 56	

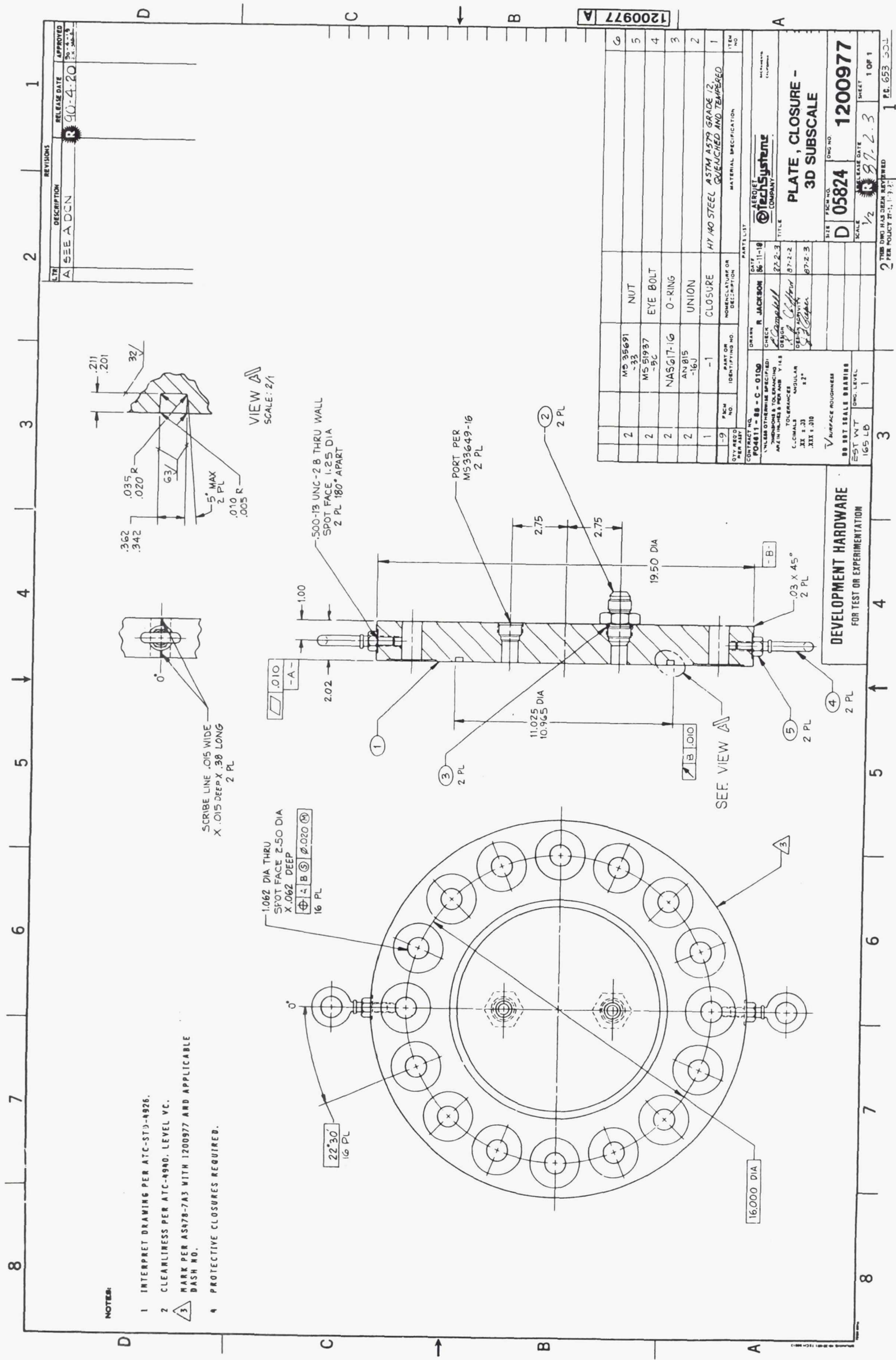


Figure D-23

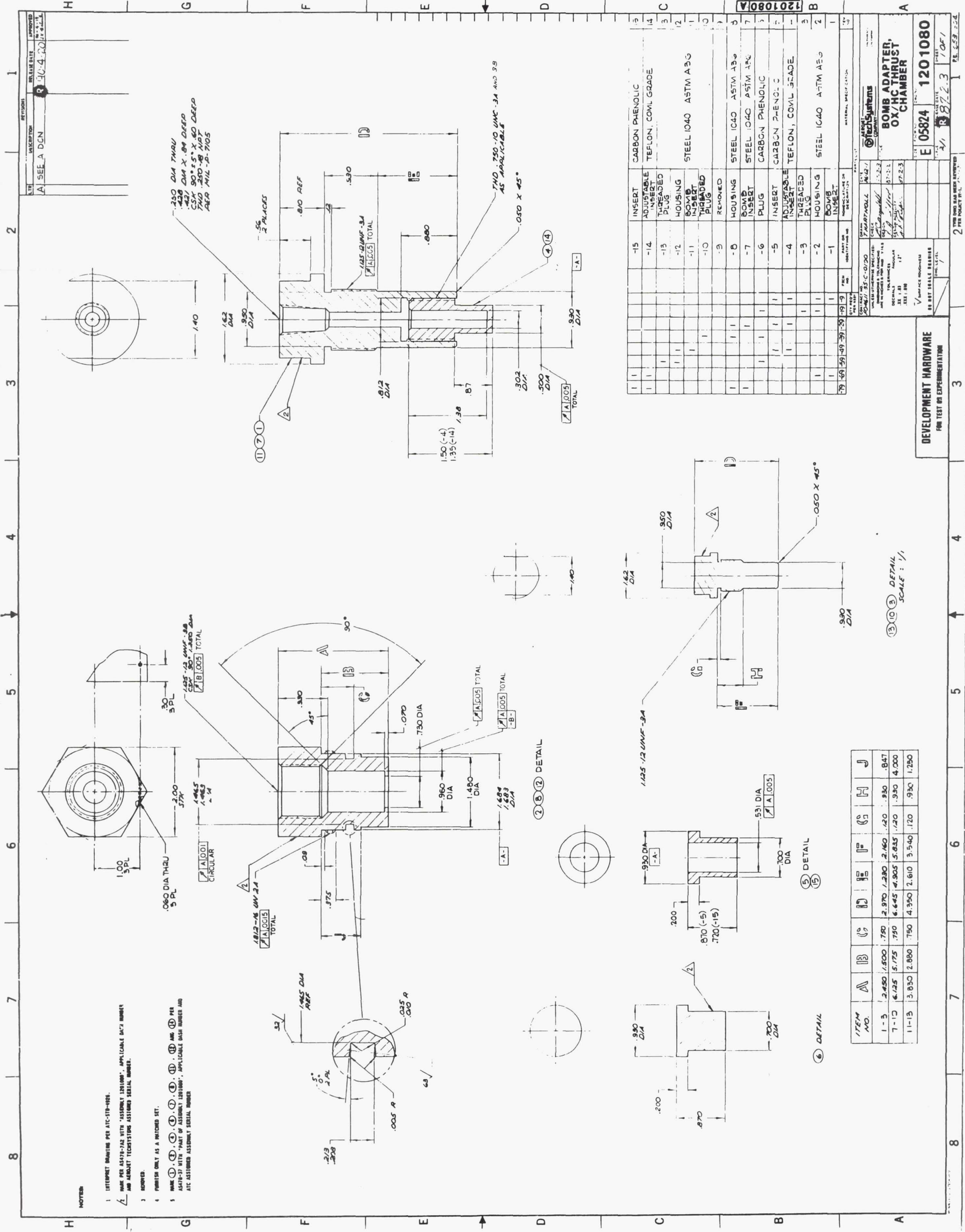


Figure D-27

APPENDIX E

ADVANCED DOCUMENT CHANGE
NOTICES FOR THE ROCCID
DESIGN DISCLOSURE

ADCN	<input type="checkbox"/> DCN	DATE	91-3-8
ECTA NO		RELEASE DATE	

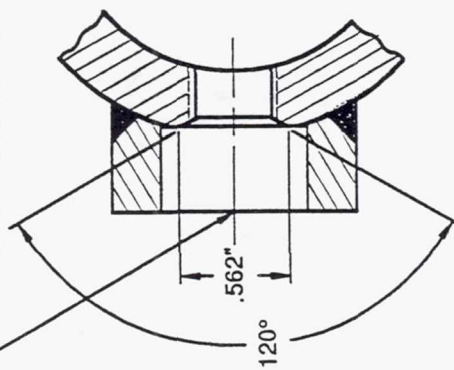
DOCUMENT CHANGE NOTICE	
GENCORP AEROJET	TechSystems SACRAMENTO, CALIFORNIA

DWG LVL	1	DOCUMENT NUMBER	1206427	REV LTR	A-1
DOCUMENT TITLE		INJECTOR ASSY, OX/HC			

PREPARED BY		L. MYERS		APPROVALS	
SH	ZONE	ITEM	DESIGN	CHECK	MANUF
			91-03-18	15 MAR 91	91-3-15
			QA		
			STRESS	WI	
			MATE	CMO	

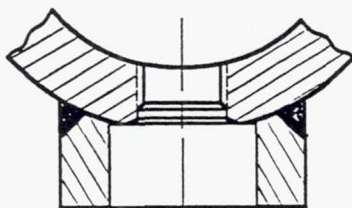
1 6 B 1 IS;

C'BORE .750 DIA X .437 DEEP
.4375-20UNF-2B THRU



WAS;

C'BORE .750 DIA X .437 DEEP
PORT PER MS33649-04
EXCEPT .4375-20UNF-2B THRU ONE WALL



DOCUMENTATION CHANGE NOTICE
CONTINUATION SHEET

FSCM NO. 05824

ADCN	<input type="checkbox"/> DCN	DATE 91-3-8	DWG LEVEL 1	DOCUMENT NUMBER 1206427	REV LTR NC-1	SHEET 2	OF 3
------	------------------------------	----------------	----------------	----------------------------	-----------------	------------	---------

SH	ZONE	ITEM	
1	GN	2	<p>IS; NOTE 9 TEST ASSEMBLY IN THE FOLLOWING ORDER:</p> <p>A. LEAK TEST ASSEMBLY PER ATC-47063, METHOD II, USING CLEAN DRY NITROGEN AT 50 ±5 PSIA. HOLD FOR 5 MINUTES MINIMUM. NO LEAKAGE ALLOWED.</p> <p>B. FLOW TEST WITH CLEAN WATER (PER ATC-STD-4940, LEVEL 1000) AS FOLLOWS:</p> <ol style="list-style-type: none"> PERFORM VISUAL PATTERN CHECK PER COGNIZANT DESIGN ACTIVITY. THE OXIDIZER AND FUEL CIRCUITS SHALL BE FLOWED SEPARATELY AT SEVERAL FLOWRATES BELOW CAVITATION ONSET (~ 50 PSIG ΔP). FOR EACH DATA POINT RECORD THE MANIFOLD ΔP, FLOWRATE, NOMINAL WATER FLOW TEMPERATURE AND ACTUAL OUTPUT FREQUENCY OF FLOWMETER. CALCULATE K_w: $K_w = \frac{\dot{w}}{(\Delta P) (S_g)}$ <p>WHERE: \dot{w} = FLOWRATE, LB/SEC ΔP = INLET - OUTLET PRESSURE, PSI S_g = SPECIFIC GRAVITY OF WATER AT FLOW TEMPERATURE</p>

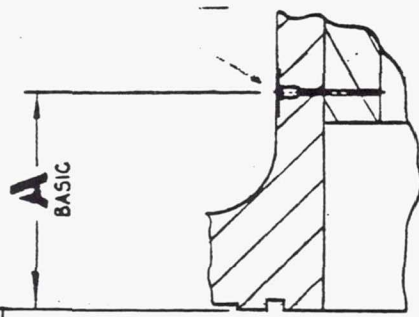
<input checked="" type="checkbox"/> ADCN		<input type="checkbox"/> DGN	DATE 91-3-8	DWG LEVEL 1	DOCUMENT NUMBER 1206427	REV LTR NC-1	SHEET 3	OF 3
1	GN	2	<p>WAS; NOTE 9 TEST ASSEMBLY IN THE FOLLOWING ORDER:</p> <p>A. ULTRASONIC INSPECT BRAZE JOINT PER ATC-STD-4819, TYPE I. ACCEPTANCE PER COGNIZANT DESIGN ACTIVITY.</p> <p>B. PROOF TEST BRAZE JOINT BY FLOWING CLEAN WATER (PER ATC-STD-4940, LEVEL 1000) SIMULTANEOUSLY THRU THE OXIDIZER AND FUEL CIRCUITS TO ATMOSPHERE. HOLD FOR APPROXIMATELY FIVE MINUTES.</p> <p style="margin-left: 20px;">OXIDIZER CIRCUIT: MANIFOLD P = 750 ±10 PSI; APPROX FLOW = 175 LB/SEC</p> <p style="margin-left: 20px;">FUEL CIRCUIT: MANIFOLD P = 710 ±10 PSI; APPROX FLOW = 85 LB/SEC</p> <p>C. REPEAT ULTRASONIC INSPECT OF BRAZE JOINT PER ATC-STD-4819, TYPE I. NOTE ANY DIFFERENCES. ACCEPTANCE PER COGNIZANT DESIGN ACTIVITY.</p> <p>D. LEAK TEST ASSEMBLY PER ATC-47063, METHOD II, USING CLEAN DRY NITROGEN AT 50 ±5 PSIA. HOLD FOR 5 MINUTES MINIMUM. NO LEAKAGE ALLOWED.</p> <p>E. FLOW TEST WITH CLEAN WATER (ATC-STD-4940, LEVEL 1000) AS FOLLOWS:</p> <ol style="list-style-type: none"> 1. PERFORM VISUAL PATTERN CHECK PER COGNIZANT DESIGN ACTIVITY. 2. THE OXIDIZER AND FUEL SHALL BE FLOWED SEPARATELY AT THE FOLLOWING FLOW RATES: OXIDIZER: 25, 35, 45, 55, 65; FUEL: 20, 25, 35, 40, 45. FOR EACH DATA POINT RECORD THE MANIFOLD ΔP, FLOWRATE, NOMINAL WATER FLOW TEMPERATURE AND ACTUAL OUTPUT FREQUENCY OF FLOWMETER. CALCULATE K_w: $K_w = \frac{\dot{w}}{(\Delta P)^{0.5} (Sg)}$ <p>WHERE: \dot{w} = FLOWRATE, LB/SEC ΔP = INLET - OUTLET PRESSURE, PSI Sg = SPECIFIC GRAVITY OF WATER AT FLOW TEMPERATURE</p>					

ADCN <input type="checkbox"/> DCN		DATE 91-2-25	DOCUMENT CHANGE NOTICE		DWG LVL 1	DOCUMENT NUMBER 1206428	REV LTR NC-1
TECH NO.		RELEASE DATE	TENACORP AEROJET	TechSystems SACRAMENTO, CALIFORNIA	DOCUMENT TITLE INJECTOR CORE ASSY, OX/HC	SHEET 1 OF 3	
PREPARED BY L. MYERS							

APPROVALS			
DESIGN	DESIGN ACTIVITY	CHECK	STRESS
91-03-18 <i>[Signature]</i>	15 MAR 91 <i>[Signature]</i>		
SH	ZONE	ITEM	MANUF
			91-2-28
			CMO

ADDED;

2 5F 1

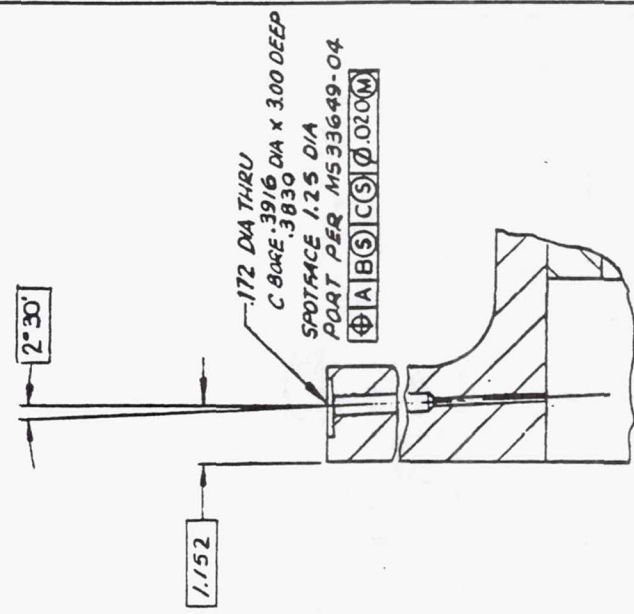


- A -

REMOVED;

2 5C 1

WAS;



SECTION K-K
LOCATED AT 142.500°



SECTION **K-K**
LOCATED AT 142.500°

**DOCUMENTATION CHANGE NOTICE
CONTINUATION SHEET**

<input checked="" type="checkbox"/> ADCN	<input type="checkbox"/> DCN	DATE 91-2-25	DWG LEVEL 1	DOCUMENT NUMBER 1206428	REV LTR NC-1	SHEET 2 OF 3
--	------------------------------	------------------------	-----------------------	-----------------------------------	------------------------	-------------------------------

SH	ZONE	ITEM	
2	4 F	3	<p>IS;</p> <p>.172 DIA THRU C'BORE .3916 DIA X 3.00 DEEP SPOTFACE 1.25 DIA PORT PER MS33649-04</p> <div style="display: flex; justify-content: space-between;"> <div> $\text{⊕ A B S C S } \text{⊕ } \text{⌀ } .020 \text{ (M)}$ </div> <div> <p>WAS;</p> <p>.172 DIA THRU C'BORE .3916 DIA X 3.00 DEEP SPOTFACE 1.25 DIA PORT PER MS33649-04</p> <div> $\text{⊕ A B S C S } \text{⊕ } \text{⌀ } .020 \text{ (M)}$ </div> </div> </div>
1	6 F	4	<p>IS;</p> <p>1.062 DIA THRU 18 HOLES</p> <div> $\text{⊕ A B S C S } \text{⊕ } \text{⌀ } .010 \text{ (M)}$ </div> <p>WAS;</p> <p>1.062 DIA THRU SPOTFACE 2.50 DIA FAR SIDE ONLY, 18 HOLES</p> <div> $\text{⊕ A B S C S } \text{⊕ } \text{⌀ } .010 \text{ (M)}$ </div>
1	1 C	5	<p>IS;</p> <p>1.062 DIA THRU SPOTFACE 2.50 DIA FAR SIDE ONLY</p> <div> $\text{⊕ D B S C S } \text{⊕ } \text{⌀ } .020 \text{ (M)}$ </div> <p>16 PL EQ SP</p> <p>WAS;</p> <p>1.062 DIA THRU SPOTFACE 2.50 DIA FAR SIDE ONLY</p> <div> $\text{⊕ D B S C S } \text{⊕ } \text{⌀ } .020 \text{ (M)}$ </div> <p>16 PL EQ SP</p>

<input checked="" type="checkbox"/> ADCN <input type="checkbox"/> DCN		DATE 91-2-25	DWG LEVEL 1	DOCUMENT NUMBER 1206428	REV LTR NC-1	SHEET 3 OF 3
---	--	------------------------	-----------------------	-----------------------------------	------------------------	-------------------------------

SH	ZONE	ITEM										
1	2 A	6	IS;									
			<div style="text-align: center;">  </div>									
			<div style="text-align: center;">  </div>									
			WAS;									

QTY REQ'D PER ASSY	FROM/CAGE NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	ZONE	ITEM NO.
4		NAS334CPA10	BOLT			10
1		-9	ASSY			9
1		1200976-2	RETAINER			8
	AR00426	RTV GE 627	SILICON SEALANT			7
4		M551937-6C	BOLT, EYE		2 3 D	6
4		M535691-4I	NUT, HEX		2 3 C	5
						4
1		1206429-1	INSERT		1 3 E	3
						2
1		-1	CHAMBER	MAKE FROM 1206432-1	1 3 E	1
-19						

QTY REQ'D PER ASSY	FROM/CAGE NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	ZONE	ITEM NO.
	AR00426	RTV GE 560	SILICON SEALANT			7
4		M551937-6C	BOLT, EYE		2 3 D	6
4		M535691-4I	NUT, HEX		2 3 C	5
						4
1		1206429-1	INSERT		1 3 E	3
						2
1		-1	CHAMBER	MAKE FROM 1206432-1	1 3 E	1
-9						

ADCN <input type="checkbox"/> DCN		DATE 91-2-25		DOCUMENT CHANGE NOTICE		DWG LVL 1		DOCUMENT NUMBER 1200729		REV LTR A-1	
ECTA NO.		RELEASE DATE		GENCORP TECHSYSTEMS SACRAMENTO, CALIFORNIA		DOCUMENT TITLE INJECTOR CORE ASSY, OX/HC		SHEET 1 OF 1			
PREPARED BY L. MYERS				APPROVALS							
SH	ZONE	ITEM	DESIGN	DESIGN ACTIVITY	CHECK	STRESS	WT				
				<i>91-03-13</i> <i>91-03-13</i>	<i>15 MAR 91</i>						
				<i>91-03-13</i> <i>91-03-13</i>	<i>91-3-15</i>						
1	GN	1	IS;	RADIUS THE ORIFICE INLETS USING ONE OF THE FOLLOWING PROCESS:							
			A.	ELECTROPOLISH INDICATED SIDE USING A SOLUTION OF 50% PHOSPHORIC ACID/50% DEIONIZED WATER AND 100 AMPS/FT ² CURRENT. CONTINUE PROCESS UNTIL 0.001-0.0015 INCHES OF MATERIAL IS REMOVED AND ORIFICE INLETS HAVE A SLIGHT RADIUS.							
			B.	MICRO BLAST INDICATED SIDE USING 100 MICRON SILICON CARBIDE GLASS BEADS FOR ≈10 SEC. CONTINUE PROCESS UNTIL ALL BURRS ARE REMOVED AND A 0.001-0.0015 INCH RADIUS IS ACHIEVED ON THE ORIFICE INLETS.							
			WAS;	ELECTROPOLISH INDICATED SIDE USING A SOLUTION OF 50% PHOSPHORIC ACID/50% DEIONIZED WATER AND 100 AMP/FT ² CURRENT. CONTINUE PROCESS UNTIL 0.001-0.0015 INCHES OF MATERIAL IS REMOVED AND ORIFICE INLETS HAVE A SLIGHT RADIUS.							

<input checked="" type="checkbox"/> ADCN		<input type="checkbox"/> DCN	DATE 2-27-91	DWG LEVEL 1	DOCUMENT NUMBER 1200773	REV LTR A-2	SHEET 2 OF 2
--	--	------------------------------	-----------------	----------------	----------------------------	----------------	-----------------

SH	ZONE	ITEM					
1	1A	1	WAS;				

QTY REQD PER ASSY	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	ZONE	ITEM NO.
1	AR	WELD ROD	ER316	10	
1	1	ASSY		1	4
AR	AR	WELD ROD	ER308		8
	1	BUTT WELD HUB	2"GR 20 SCH 160	3	7
	1	TUBE	ASTM-A312 TYPE 304	3	6
	1	BOSS	QQ-S-763 CL304 COND A	3	5
1		OUTER RING	CRES	1	4
1		INNER RING	ASTM A473 OR ASTM A167 TYPE 304	1	3
		OUTER RING	CRES	1	2
1		INNER RING	ASTM A473 OR ASTM A167 TYPE 304	1	1
29	19-9				

APPENDIX F
NONCONFORMANCE REPORTS

PRINT OR TYPE IN BLACK INK

NONCONFORMANCE REPORT

G.F.M.

NO. V21264

PAGE 1 OF 1

[illegible]

TECH-00035A (REV 9/87)

PRINT OR TYPE IN BLACK INK

NONCONFORMANCE REPORT

G.F.M.

No.

NO. V21284

PAGE 1 OF 1

COMPANY 1200729		DASH REV. -1 A		2. NOMENCLATURE INJECTOR CORE		3. SERIAL NO.		4. PROGRAM 3D SUBSCALE		5. LOT SIZE 1		6. ACC.		7. DISC.	
8. WORK ORDER		9. SHOP ORDER S/O 4444		10. OPER. NO.		11. SUPPLIER NAME MARTINEZ & TUREK		12. P.O. NUMBER L823839		13. DISTRIBUTION NO.		14. PREVIOUS NR NUMBER			
14. NONCONFORMANCE		(A) DWG. ZONE, SPEC., PARA., SHOP ORDER OPER., ETC AS APPLICABLE		(B) STATE REQUIREMENT (C) INSPECTION RESULTS		15. (A) CAUSE Q/C		15. (B) FREQ OCCUR		16. DISPOSITION/COMMENTS		16. DISPOSITION/COMMENTS			
ITEM		1		REF. DWG. SHEET 4/7, ZONE: F-8		SHOULD BE: $\phi 11.336 \pm .000$		IS: $\phi 11.331$ at 68° F		Us As Is; the smaller diametrical dimension will not affect the assembly nor will it jeopardize the seal of the o-ring.					
2		REF. DWG SHEET 3/7, ZONE: A-3		SHOULD BE: $.022 \pm .001$ @ 8 places, (BRAZE CHANNEL DEPTH)		IS: ACCEPTABLE AT (7) LOCATIONS, (1) LOCATION ($\phi 1.888$) FOUND TO BE .024" DEEP.				Us As Is; the difference of .001" in channel depth will not change the flow characteristics to detriment the hardware performance.					
17. INITIATOR IDENTITY S. NICKERSON		DATE 18 REVIEWED BY S. Nickerson 2-1-91		DATE 19 PROCEED S. Nickerson 2-1-91		DATE 20 RESPECT QTY		DATE 21 MRB/ERB APPROVALS		DATE 22 MRB/ERB RESUBMIT DECISIONS		DATE 23 CORRECTIVE ACTION		DATE 24	
18. REPR J. J. Cupu 2-1-91		DATE 19 QA REPR		DATE 20 JUST REPR		DATE 21 ENGR REPR		DATE 22 QA REPR		DATE 23		DATE 24		RESUBMIT FOR	
19. REPR James Myers 2-1-91		DATE 20 QA REPR		DATE 21 JUST REPR		DATE 22 ENGR REPR		DATE 23		DATE 24		DATE 25		DATE 26	
20. CAUSE		21. CAUSE		22. CAUSE		23. CAUSE		24. CAUSE		25. CAUSE		26. CAUSE		27. CAUSE	
21. OPERATOR ERROR		22. OPERATOR ERROR		23. OPERATOR ERROR		24. OPERATOR ERROR		25. OPERATOR ERROR		26. OPERATOR ERROR		27. OPERATOR ERROR		28. OPERATOR ERROR	
22. OPERATOR ERROR		23. OPERATOR ERROR		24. OPERATOR ERROR		25. OPERATOR ERROR		26. OPERATOR ERROR		27. OPERATOR ERROR		28. OPERATOR ERROR		29. OPERATOR ERROR	
23. OPERATOR ERROR		24. OPERATOR ERROR		25. OPERATOR ERROR		26. OPERATOR ERROR		27. OPERATOR ERROR		28. OPERATOR ERROR		29. OPERATOR ERROR		30. OPERATOR ERROR	
24. OPERATOR ERROR		25. OPERATOR ERROR		26. OPERATOR ERROR		27. OPERATOR ERROR		28. OPERATOR ERROR		29. OPERATOR ERROR		30. OPERATOR ERROR		31. OPERATOR ERROR	
25. OPERATOR ERROR		26. OPERATOR ERROR		27. OPERATOR ERROR		28. OPERATOR ERROR		29. OPERATOR ERROR		30. OPERATOR ERROR		31. OPERATOR ERROR		32. OPERATOR ERROR	
26. OPERATOR ERROR		27. OPERATOR ERROR		28. OPERATOR ERROR		29. OPERATOR ERROR		30. OPERATOR ERROR		31. OPERATOR ERROR		32. OPERATOR ERROR		33. OPERATOR ERROR	
27. OPERATOR ERROR		28. OPERATOR ERROR		29. OPERATOR ERROR		30. OPERATOR ERROR		31. OPERATOR ERROR		32. OPERATOR ERROR		33. OPERATOR ERROR		34. OPERATOR ERROR	
28. OPERATOR ERROR		29. OPERATOR ERROR		30. OPERATOR ERROR		31. OPERATOR ERROR		32. OPERATOR ERROR		33. OPERATOR ERROR		34. OPERATOR ERROR		35. OPERATOR ERROR	
29. OPERATOR ERROR		30. OPERATOR ERROR		31. OPERATOR ERROR		32. OPERATOR ERROR		33. OPERATOR ERROR		34. OPERATOR ERROR		35. OPERATOR ERROR		36. OPERATOR ERROR	
30. OPERATOR ERROR		31. OPERATOR ERROR		32. OPERATOR ERROR		33. OPERATOR ERROR		34. OPERATOR ERROR		35. OPERATOR ERROR		36. OPERATOR ERROR		37. OPERATOR ERROR	
31. OPERATOR ERROR		32. OPERATOR ERROR		33. OPERATOR ERROR		34. OPERATOR ERROR		35. OPERATOR ERROR		36. OPERATOR ERROR		37. OPERATOR ERROR		38. OPERATOR ERROR	
32. OPERATOR ERROR		33. OPERATOR ERROR		34. OPERATOR ERROR		35. OPERATOR ERROR		36. OPERATOR ERROR		37. OPERATOR ERROR		38. OPERATOR ERROR		39. OPERATOR ERROR	
33. OPERATOR ERROR		34. OPERATOR ERROR		35. OPERATOR ERROR		36. OPERATOR ERROR		37. OPERATOR ERROR		38. OPERATOR ERROR		39. OPERATOR ERROR		40. OPERATOR ERROR	
34. OPERATOR ERROR		35. OPERATOR ERROR		36. OPERATOR ERROR		37. OPERATOR ERROR		38. OPERATOR ERROR		39. OPERATOR ERROR		40. OPERATOR ERROR		41. OPERATOR ERROR	
35. OPERATOR ERROR		36. OPERATOR ERROR		37. OPERATOR ERROR		38. OPERATOR ERROR		39. OPERATOR ERROR		40. OPERATOR ERROR		41. OPERATOR ERROR		42. OPERATOR ERROR	
36. OPERATOR ERROR		37. OPERATOR ERROR		38. OPERATOR ERROR		39. OPERATOR ERROR		40. OPERATOR ERROR		41. OPERATOR ERROR		42. OPERATOR ERROR		43. OPERATOR ERROR	
37. OPERATOR ERROR		38. OPERATOR ERROR		39. OPERATOR ERROR		40. OPERATOR ERROR		41. OPERATOR ERROR		42. OPERATOR ERROR		43. OPERATOR ERROR		44. OPERATOR ERROR	
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39. OPERATOR ERROR		40. OPERATOR ERROR		41. OPERATOR ERROR		42. OPERATOR ERROR		43. OPERATOR ERROR		44. OPERATOR ERROR		45. OPERATOR ERROR		46. OPERATOR ERROR	
40. OPERATOR ERROR		41. OPERATOR ERROR		42. OPERATOR ERROR		43. OPERATOR ERROR		44. OPERATOR ERROR		45. OPERATOR ERROR		46. OPERATOR ERROR		47. OPERATOR ERROR	
41. OPERATOR ERROR		42. OPERATOR ERROR		43. OPERATOR ERROR		44. OPERATOR ERROR		45. OPERATOR ERROR		46. OPERATOR ERROR		47. OPERATOR ERROR		48. OPERATOR ERROR	

PRINT OR TYPE IN BLACK INK

NONCONFORMANCE REPORT

G.F.M.

NO. V21221

PAGE 1 OF 2

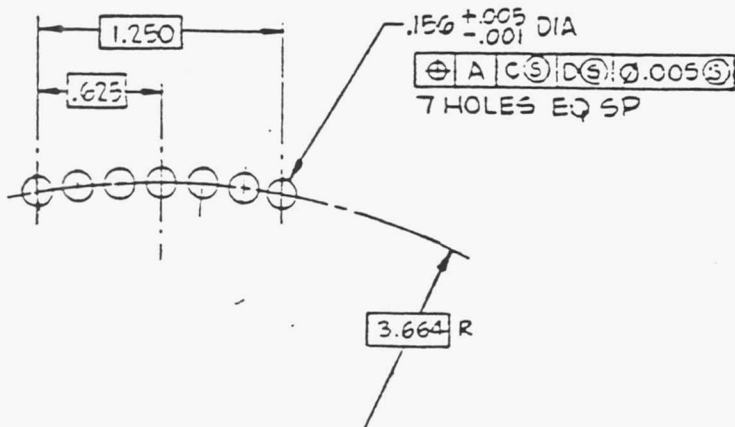
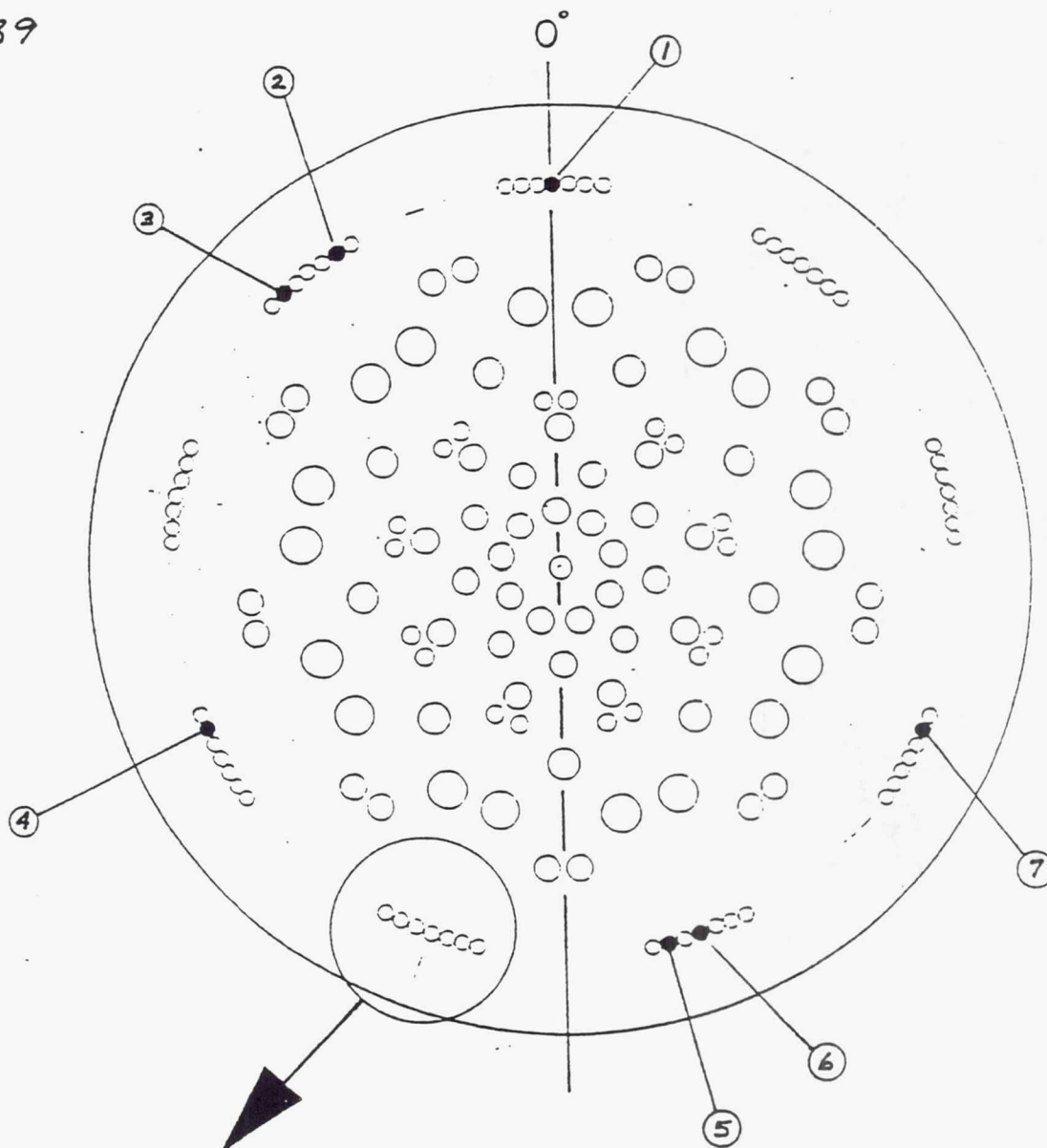
COMPANY 1. PART NUMBER 1200729		AREA 2. NOMENCLATURE INJECTOR CORE		3. SERIAL NO.		4. PROGRAM		5. LOT SIZE		6. ACC.		7. DISC.	
8. WORK ORDER KFN 600		9. SHOP ORDER Vendor S/O 4444		10. OPER. NO.		11. SUPPLIER NAME MARTINEZ & TUREK		12. P.O. NUMBER MA2551823839		13. DISTRIBUTION NO.		14. PREVIOUS NR NUMBER	
15. NONCONFORMANCE		(A) DWG. ZONE, SPEC., PARA., SHOP ORDER OPER., ETC AS APPLICABLE		(B) STATE REQUIREMENT (C) INSPECTION RESULTS		16. DISPOSITION/COMMENTS		17. EFB		18. ITEMS		19. EFB	
1. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
2. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
3. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
4. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
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8. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
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10. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
11. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
12. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
13. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
14. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
15. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
16. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
17. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
18. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
19. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
20. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
21. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
22. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
23. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
24. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
25. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
26. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
27. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
28. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
29. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .156 ±.005		9 Equal Spaces		IS: True position varies up to .020,		(See Attached for Discrepant locations) 7 pls.					
30. REF: DWG. SHEET -4, Zone: D-5		Should be: Ø .											

ATC PN# 1200729

✓2/221

-1 INJECTOR CORE

P.O.# L823839



VIEW S 4 2
6
9 PL THRU EQ SP
SCALE: 2/1

HOLE NO. #	TRUE POSITION
1	.006
2	.020
3	.006
4	.006
5	.012
6	.007
7	.0085

TECH-00035A (REV 9/87)

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

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6. AUTHOR(S) Karen E. Niiya and Richard E. Walker				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Aerojet Propulsion Division P.O. Box 13222 Sacramento, California 95813			8. PERFORMING ORGANIZATION REPORT NUMBER E-7827	
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13. ABSTRACT (Maximum 200 words) <p>This final report includes a discussion of the work accomplished on contract NAS 3-25556 during the period from December 1988 through November 1991. The objective of the program was to assemble existing performance and combustion stability models into a usable design methodology capable of designing and analyzing high-performance and stable LOX/Hydrocarbon booster engines. The methodology was then used to design a validation engine. The capabilities and validity of the methodology were demonstrated using this engine in an extensive hot fire test program. The engine used LOX/RP-1 propellants and was tested over a range of mixture ratios, chamber pressures and acoustic damping device configurations. This volume contains time domain and frequency domain stability plots which indicate the pressure perturbation amplitudes and frequencies from approximately 30 tests of a 50K thrust rocket engine using LOX/RP-1 propellants over a range of chamber pressures from 240 to 1750 psia with mixture ratios of from 1.2 to 7.5. The data is from test configurations which used both bitune and monotune acoustic cavities and from tests with no acoustic cavities. The engine had a length of 14 inches and a contraction ratio of 2.0 using a 7.68 inch diameter injector. The data was taken from both stable and unstable tests. All combustion instabilities were spontaneous in the first tangential mode. Although stability bombs were used and generated over pressures of approximately 20%, no tests were driven unstable by the bombs. The stability instrumentation included six high-frequency Kistler transducers in the combustion chamber, a high-frequency Kistler transducer in each propellant manifold, and tri-axial accelerometers. Performance data is presented, both characteristic velocity efficiencies and energy release efficiencies, for those tests of sufficient duration to record steady state values.</p>				
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